אורט בראודה
המכללה האקדמית להנדסה
ORT Braude College

RESEARCH
AT
ORT BRAUDE COLLEGE
2013-2015

RESEARCH ORT BRAUDE COLLEGE 2013-2015

אורט בראודה
ORT Braude College

RESEARCH AT ORT BRAUDE COLLEGE

2013-2015

אורט בראודה
ORT Braude College

Compiled by:
Zeev Barzily
Marei Sammar
Keren Berkovitz

Produced by:
ORT Braude College Office of the
Vice President for Academic Affairs
Research Authority

ISBN 978-965-7468-02-9

Table of Contents

Prof. Arie Maharshak,
President

ORT BRAUDE ACADEMIC COLLEGE OF ENGINEERING

Since its establishment in the early 1990s, ORT Braude Academic College of Engineering has positioned itself as one of the leading Israeli institutions for engineering and sciences, well-known for its excellence in both education and research. Having received institutional administrative independence, the College is moving steadily forward in building an autonomous campus in which our students and faculty may continue to cultivate higher education and cutting-edge research.

ORT Braude Academic College of Engineering development efforts include expanding its undergraduate and graduate programs, opening new B.Sc. degrees, such as Civil Engineering and Medical Sciences, as well as graduate research programs in various engineering fields and mathematics. These programs will constitute yet another platform for further growth and opportunity for research.

At ORT Braude Academic College of Engineering, our dedication to excellence and high academic standards provides our graduates with the education and skills necessary to meet their personal and professional goals in engineering and in science. By cultivating independent learning, we prepare our students to excel as engineers in a rapidly changing technological world. We also invest substantial resources in training and improving teaching methods, and providing student support systems to create an environment that is both nurturing and challenging.

Our principal goal is to continue to develop the College as a leading academic institution. To this end, we remain committed to uncompromising academic excellence and the cultivation of productive and rewarding educational experiences.

ORT Braude College confers a Bachelor of Sciences (B.Sc.) degree in the following fields:

- Applied Mathematics
- Biotechnology Engineering
- Electrical and Electronic Engineering
- Industrial Engineering and Management
- Information Systems Engineering
- Mechanical Engineering
- Optical Engineering
- Software Engineering

ORT Braude College confers a Master of Sciences (M.Sc.) degree in the following fields:

- Biotechnology Engineering
- Industrial Engineering and Management
- Systems Engineering
- Software Engineering
- Mechanical Engineering (as of 2016/2017 Academic year)

The College is continually developing new study programs, in step with the country's economic and industrial development. In addition to academic degrees (B.Sc. and M.Sc.), the College also offers students the following educational programs:

- Pre-Academic Studies
- Practical Engineering
- Continuing Education
- Youth Center for Science Enrichment
- Teacher Certification in Science and Technology

Mission

We are a higher education institution of engineering, technology, and related fields, whose goal is to promote equal opportunities in Israeli society through education and professional training.

Vision

A leading engineering degree in Israel

Values

Our graduates will be multidisciplinary engineers, and possess:

- A general and professional education that is simultaneously broad-based and in-depth
- The ability and desire for independent study and teamwork
- The ability to adapt knowledge to changing needs
- Critical thinking skills
- A creative, innovative, and entrepreneurial approach
- Social and environmental awareness

Our faculty members will be:

- Teachers for life
- Up to date in their professional field, in addition to possessing a broad education
- Dedicated to the ideal image of the graduate, as detailed above, with the ability to enable their students to attain these goals
- Able and willing to motivate their students, stimulate their curiosity, and create relevant and up-to-date connections
- Active, high-quality researchers participating in significant research projects
- Involved in the college, the environment, and the academic and professional community

Our administrative staff will:

- Possess current professional knowledge in addition to a broad-based education
- Leverage the college's infrastructure and systems to the standard required

Our college will:

- Be innovative and pioneering in its teaching methods and in the quality of its teaching
- Attract young, motivated faculty members and enthusiastic students
- Promote an academic atmosphere which is equally formal and informal
- Encourage high quality research
- Always retain its pioneering spirit, emphasize teaching quality, and promote the educational values of the ORT network in Israel, even as it grows and develops
- Act as a natural continuation of ORT graduates' education
- Lead and influence intellectual, cultural and social development both close to home and beyond

Consistent with our vision, research has played an increasingly important role at OBC over the last decade. This publication summarizes the College's research achievements during the three-year period, 2013-2015. During this period, approximately 112 permanent and adjunct faculty members carried out research projects in 175 research areas, yielding 194 published papers in refereed journals and over 220 papers presented at professional conferences, both national and international.

Through their involvement in research and related activities, researchers position themselves in the mainstream of information flow regarding progress in their fields of research. Furthermore, being up-to-date in current developments offers researchers added value and superior academic teaching credentials.

Prof. Zeev Barzily,
Vice President for Academic Affairs

RESEARCH CENTERS

THE GALILEE RESEARCH CENTER FOR APPLIED MATHEMATICS

The Galilee Research Center for Applied Mathematics was established by the Department of Mathematics of ORT Braude College. The Center reflects ongoing research collaboration with universities in Israel and abroad, as well as the Department's educational efforts in the Applied Mathematics program and in the mathematics education of engineering students in our College. We strongly believe that a high level research is crucial for maintaining excellence in teaching.

Among our activities is a series of seminars hosting mathematicians from other universities in Israel and abroad, as well as applied mathematicians working in the industry.

Since 1998, our Department has organized several international conferences. In May 2011, the 5th International Conference on Complex Analysis & Dynamical Systems, organized in collaboration with Bar-Ilan University and the University of Miami, was held in Akko (Acre).

Particularly worthy of note is our extensive collaboration with Bar-Ilan University (Ramat-Gan, Israel), Technion – Israel Institute of Technology (Haifa, Israel), University of Potsdam (Germany), Royal Institute of Technology (Stockholm, Sweden), University of Kentucky (USA), Instituto Politécnico Nacional (Mexico), Universidad Complutense Madrid (Spain), and Peoples' Friendship University (Russia).

Our research fields include: geometric function theory, dynamical systems, biomathematics, functional analysis, operator theory, partial differential equations, mathematical physics equations, mathematical control theory, differential games and mathematics education..

For more information on the Galilee Research Center, contact:
Prof. Lavi Karp
karp2@braude.ac.il
+972-(0)4-990-1974

DATA MINING INSTITUTE

The mission of the Data Mining Institute is to utilize the expertise and research of the Department of Software Engineering at ORT Braude College to discover and invent novel and powerful tools for extracting knowledge and solving scientific, business and economic problems. Current internships cover the following fields: heuristic approaches to search networks consistent with experimental data, within the framework of the FP7 grant "New Algorithms for Host Pathogen Systems Biology"; optimization of technical service schedules, under the auspices of the ASTEA International Inc.; and an investigation of user activities, as part of an agreement with the Paris branch of ORANCE. The Institute carries out many studies in the fields of cluster validation, graph clustering and application of machine learning methodology to software engineering problems

For more information on the Data Mining Institute, contact:
Prof. Zeev Volkovich
vlvolkov@braude.ac.il
+972-(0)4-990-1994
+972-(0)-50-404-1359

CRANET - CRANFIELD NETWORK ON COMPARATIVE HUMAN RESOURCE MANAGEMENT

Cranet is an established group of top business schools and academic institutions that collaborate to provide unique and rigorous data on human resource management practices worldwide. Cranet provides a coherent and accurate picture of international and comparative Human Resource Management (HRM). To date, 40 countries around the world have joined the project. The Centre for European Human Resource Management at the Cranfield School of Management (UK) coordinates this collaboration of universities and business schools in the participating countries.
In Israel, Dr. Hilla Peretz of the Department of Industrial Engineering and Management, ORT Braude College, directs Cranet. Additional information and reports are available at our website:
http://www.braude.ac.il/research_and_development/cranet

For more information on CARNET, contact:
Dr. Hilla Peretz
hillap@braude.ac.il
+972–(0)4-990-1852
+972–(0)52-551-0343

TEACHING AND LEARNING CENTER RESEARCH ACTIVITY

The Teaching & Learning Center (TLC) was established in 2004 in conjunction with the College's strategy of promoting student learning and thinking skills, lowering first-year dropout rates, and enhancing excellence in teaching.

TLC programs include required courses for all freshmen students, designed to promote learning and thinking skills. The Center also provides small group, peer-led workshops run by high-achieving students, in a collaborative problem-solving setting, a program for supporting underachieving students, and personal academic coaching given by trained College lecturers for students with unsatisfactory academic learning habits.

TLC also offer courses to lecturers. The programs are intended to enhance lecturers' instruction methods and include a process for orientation and support of new lecturers.

TLC's main programs are continually studied in order to assess their effectiveness and provide recommendations for future application and development. We strive to uncover where students are having difficulties and possible reasons for failures, as well as determine faculty needs regarding teaching enhancement. The research data is drawn from the performance of participating students as well as from the perceptions of students and lecturers regarding the programs' contribution.

For more information on TLC, contact:
Secretary at Teaching and Learning Center
tlc@braude.ac.il
+972-(0)4-990-1724

RESEARCH AUTHORITY

The Research Authority was established in 2010 to encourage, support, promote and monitor the research activities of the academic staff at OBC as well as to serve as a scientific, administrative and management framework for research activities at the college.

The activities of the Research Authority include:

- Location, collection, accumulation and dissemination of information about external sources of funding, including government ministries, the Israel Science Foundation (ISF), European programs (FP7), bilateral programs (GIF, BSF) and other funding agencies.
- Guidance and administrative services in submitting research proposals to funding agencies, including advice and support in preparation of budgets for research proposals.
- Provision of financial support for editing grant proposals.
- Assistance in matching OBC researchers with funding sources.
- Assistance in finding research partners and creating consortium or partnership agreements.
- Negotiation with agencies that fund the grant and sign the contracts.
- Financial and administrative management of grants and contracts of funded projects.
- Initiation of research contracts between OBC scientists and researchers at other universities, both in Israel and abroad.

- Initiation and organization of workshops concerning external funding for information transfer and improving researchers' ability to write competitive grants.

For more information on Research Authority, contact:
Prof. Marei Sammar, Director of the Research Authority
sammar@braude.ac.il
+972-4-990-1769
+972 54 404-1366

OFEK ESHKOLOT RESEARCH AND DEVELOPMENT LTD

ORT Braude College established Ofek Eshkolot Research and Development Ltd. to encourage the research being conducted within the College by expanding ties with industry, and promoting patents and licensing. The company acts as the College's business arm, leveraging knowledge assets and stimulating advanced industrial development in the Galilee.
From a business perspective, the company commercializes the intellectual property (IP) developed by College faculty members and/or students and/or College employees by licensing or partnering with a strategic partner.

Company goals:
- Directing staff research towards useful research and development (R&D)
- Creating intellectual property that can be commercialized, and patenting R&D products
- Obtaining patents and licensing
- Establishing partnership ventures with investors on the basis of the created IP.

The company contracts research projects with industrial and commercial entities, which are executed by faculty members, adjunct faculty, students, or professional experts whom the company recruits according to need.

For more information on Ofek Eshkolot R&D Ltd., contact:
Dr. Moshe Shavit
mshavit@braude.ac.il
+972-(0)54-331-7122

PLASTICS INSTITUTE – ORT BRAUDE COLLEGE

The goal of the Plastics Institute is to provide R&D services for the plastics industry, focusing on:
- Experimental research
- Computer modeling of processes and materials
- Consultancy services
- Courses for the industry in a variety of R&D topics, in factories or at the College.

The institute is located at ORT Braude College, at the heart of Israel's plastics industry.
The institute works alongside the College's commercialization and implementation company, Ofek Eshkolot Research and Development Ltd. The company directs faculty members towards useful R&D, creation of intellectual property (patent writing), and facilitation of business cooperation with industry.

For more information, please contact
Dr. David Alperstein
davida@braude.ac.il
+972-(0)4-990-1944

THE CENTER FOR ENTREPRENEURSHIP AND INNOVATION

The Entrepreneurship and Innovation Center at ORT Braude invites innovators from the College (staff members, administrative employees, and students) and external entrepreneurs to use the services offered by the Center to help them realize their ideas as marketable products or services. The Center is a multidisciplinary education hub, allowing students from different fields of engineering to experience the entrepreneurial process while being provided with nurturing business guidance. The Center works alongside the College's commercialization and implementation arm, Ofek Eshkolot Research and Development Ltd.

Goals

- Encouraging students, staff members, and entrepreneurs to launch their ventures.
- Creating an academic platform that allows participants to experience the process and components of entrepreneurship, present their ideas to investors, and participate in competitions.
- Promoting the ventures of students, staff members, and entrepreneurs through the business-marketing environment provided by the Galilee Accelerator.
- Continuing the commercializing process through Ofek Eshkolot Research and Development Ltd.

For more information on the Center for Entrepreneurship and Innovation, contact:
Dr. Moshe Shavit
mshavit@braude.ac.il
+972-(0)54-331-7122

THE MANUFACTURING TECHNOLOGY RESEARCH CENTER (MTRC)

The mission of the Manufacturing Technology Research Center (MTRC) at the Mechanical Engineering Department of ORT Braude College is to act as a focal point for research and development of various manufacturing technologies, emphasizing machining processes such as turning, milling and drilling. The Center develops capabilities and expertise in the field of manufacturing processes, making it a national hub for research and industrial knowledge. The

Center's objectives are to collaborate with industrial companies that develop machining tools or employ different manufacturing technologies. MTRC offers its services and collaborates in research and industrial projects in the areas of wear and life of machining tools, surface finishing of tools and workpieces, conventional and vibration-assisted drilling, monitoring of drilling processes by acoustic emission sensors, numerical modeling, dental drilling processes, metallurgy of tools and materials and friction stir welding. The equipment available at the Center includes two CNC milling machines, a CNC lathe, computer workstations with optical microscopes for measuring wear and failure characterization, sensors for measuring forces and vibrations, and software for numerical modeling and analysis of various metal cutting processes, including COMSOL, ANSYS and DEFORM. The Center works with faculty and adjunct lecturers in the Department of Mechanical Engineering who are expert researchers in the field. In addition, some projects that graduate and undergraduate students of the Department are conducting are also included in the Center's research activities.

For more information on the Manufacturing Technology Research Center, contact:

Dr. Samy Abu-Salih
Phone: +972-(0)4-990-1888
Fax: +972-(0)4-990-1945
E-mail: samyas@braude.ac.il

COLLEGE INTERDISCIPLINARY CONFERENCES

■ **THE 11th ORT BRAUDE COLLEGE INTERDISCIPLINARY RESEARCH CONFERENCE**
Hagoshrim, Israel; October 2015
http://www.braude.ac.il/conferences/research11/

■ **THE 5th INDUSTRY-ACADEMIA CONFERENCE: MULTIDISCIPLINARITY AND INTERDISCIPLINARITY AS DEVELOPMENT LEVERAGE FOR INDUSTRY AND ACADEMIA**
Karmiel, Israel; November 2014
http://conferences.braude.ac.il/taasia2014/

■ **THE 10th ORT BRAUDE COLLEGE INTERDISCIPLINARY RESEARCH CONFERENCE**
Nahariya, Israel; October 2014
http://www.braude.ac.il/conferences/research10/

■ **THE 9th ORT BRAUDE COLLEGE INTERDISCIPLINARY RESEARCH CONFERENCE**
Hagoshrim, Israel; October 2013
http://www.braude.ac.il/conferences/research09/

■ **THE 4th INDUSTRY-ACADEMIA CONFERENCE: MULTIDISCIPLINARITY AND**
INTERDISCIPLINARITY AS DEVELOPMENT LEVERAGE FOR INDUSTRY AND ACADEMIA
Karmiel, Israel; March 2013
http://conferences.braude.ac.il/IndustryAcademia2013/

Prof. Ephraim Katzir Department of Biotechnology Engineering

Prof. Sarit Sivan, Ph.D.,
Head of the Department

RESEARCH AREAS

INVESTIGATING THE OXIDATION PROCESS AND FACTORS THAT AFFECT THE FORMATION OF OXIDIZED LIPIDS (OXYLIPINS) IN OLIVE OIL

Amal Rouhana-Toubi and Ameer Taha (UC Davis – California)

Unsaturated fatty acids that exist in vegetable oils are of great nutritional importance, yet they may undergo chemical oxidation processes and enzymatic degradation that may affect their nutritional value and cause the formation of toxic metabolites. Enzymatic processes occur mainly in the early stages of production, while chemical processes occur along the storage of the oil. It is, therefore, important to monitor the process of oxidation and the development of oxygenated compounds throughout the production stages and under various storage conditions. It is known that oxidation reactions are especially accelerated in the presence of oxygen and at exposure to light and high heat, while the presence of natural antioxidants may inhibit the oxidation processes. By tracking biochemical processes that occur in oil during the production stages and under various storage conditions, we seek to identify the critical steps that are responsible for the creation of oxidized compounds and the critical factors affecting the oxidation development process. The use of advanced analytical methods (GC-MS and LC-MS) allows us to accurately identify minor changes in molecular structures of oil and monitor oil oxidation processes that occur throughout the various stages.

Keywords: Olive oil, unsaturated fatty acids, oxygenated compounds

EXTRACTION OF ANTICANCER AGENTS FROM MEDICINAL MUSHROOMS

Amal Rouhana-Toubi, Solomon P. Wasser (University of Haifa) **and Fuad Fares** (University of Haifa)

Cancer is a major public health problem, with ovarian cancer being one of the most lethal tumors of the female genital tract. Medical treatment of ovarian carcinoma has limited efficacy and is often accompanied by harmful side effects. Medicinal mushrooms, known to be a potential source of anti-cancer substances, were selected for investigation in the current research work.
We began our investigations by conducting a screening test to find the mushroom species that were most active in combatting ovarian cancer cells. The screened mushroom strains were extracted by different organic solvents, and their ability to reduce the viability of human ovarian cancer cells was examined in vitro. The ethyl acetate extract of Coprinuscomatus fruit bodies was fractionated, and its active fraction was used in further investigations. Several biological tests demonstrated that the Coprinuscomatus active fraction (CCFB-AF) induces apoptosis in three different ovarian cancer cells. Analysis revealed that CCFB-AF induced apoptosis in ovarian cancer cells via both extrinsic and intrinsic pathways. The fingerprint of the CCFB-AF composition was assembled by GC-MS, LC-MS and LC-UV techniques. Analysis revealed that CCFB-AF is a mixture of different compounds, some of which were identified by GC-MS. More analysis is needed to completely identify the active components.

Keywords: Coprinuscomatus, medicinal mushrooms, ovarian cancer, apoptosis

MOLECULAR MODELING OF ENZYME-CATALYZED POLYMERIZATION

Dafna Knani

Enzymatic polymerization could be used to prepare bio-like polymers, and especially, optically active bio-like polymers. In my research, I investigate enzymatic polymerization characteristics using computational tools, focusing on enzyme-catalyzed polymerization of polyesters. I have been studying several linear and substituted hydroxyesters with a docking procedure using GOLD (Genetic Optimization for Ligand Docking) protein-ligand software, developed by CCDC (The Cambridge Crystallographic Data Centre). I also study the enzyme-catalyzed ring-opening-polymerization of lactones in silico. In this research, the catalytic ability of several enzymes are explored, looking for their ring-opening polymerization of lactones. The calculations are compared to experimental research results obtained by myself and other researchers. Understanding these parameters can help predict the best conditions for enzyme catalysis.

Keywords: Molecular modeling, enzymatic polymerization, ligand-protein docking, biomaterials

MOLECULAR MODELING OF POLYMERS AND BIOPOLYMERS

Dafna Knani

a. Molecular modeling study of CO_2 plasticization and sorption onto absorbable polyesters

Computational tools were applied to estimate the plasticizing effect of CO_2 and calculate CO_2 and H_2O loading capacities for three absorbable polyesters: polycaprolactone (PCL) and

two copolymers of (poly-D,L-lactid-co-glycolid)-co-polyethylenglycol. Plasticization caused by CO_2 was estimated by solubility parameter and radial distribution function at several CO_2 concentrations and by enlargement of free volume detected by mean square displacement of helium atoms, calculated after dynamic simulation. It was found that the maximal value of the solubility parameter and density can serve as a tool to predict saturation concentration.The loading capacity of the biopolymers that were preloaded with CO_2 molecules was significantly higher than the non-treated polymers. Similar results were obtained for H_2O molecule loading.

Keywords: Simulation, CO_2 plasticization, absorbable polyesters

b. Simulation of novel soy protein-based structures for tissue regeneration applications

Soy protein-based porous blends, for possible use as new scaffolds in tissue engineering applications, are studied by dynamic simulation. Gelatin (protein) and alginate (polysaccharides) are attached to soy protein isolates (SPI). The structure of the soy protein was downloaded from the Protein Data Base (PDB). According to the calculations, it seems that the strong ionic interactions of the alginate chain make it difficult for the water molecules to penetrate between the chains. In contrast, the gelatin chain is more accessable to the water molecules. This observation might be the reason for the difference in the degradation rate of the two conjugates, the soy protein–gelatin degradation being faster.

Keywords: Simulation, soy protein, gelatin , aliginate

c. Simulation of the bilayer system based on neutral and cationic lipids in combination with fluorescent lipids

Liposomes mediate highly effective fusion processes with living cell membranes, and therefore, can be used for delivery of biomolecules into membranes of living cells as well as cell surface modifications. Recently, a new, simple, and almost universal fusogenic liposome system containing neutral and positively charged lipid molecules, as well as an additional lipid component with aromatic molecular groups, was described. The goal of the present study is to computationaly simulate the bilayer system and the influence of introducing the aromatic lipids into the bilayer. The system was studied by atomistic dynamic simulation of 3D periodic boundary cubic cells of the lipids as well as of the bilayer solvated with two layers of water molecules on each side. In addition, a coarse grained model of the bilayer system was constructed and subjected to dynamic simulation. According to the computational results, it seems that the introduction of the aromatic lipid into the bilayer disturbs the bilayer structure and makes it less stable, which facilitates its fusion with the cell membrane.

Keywords: Simulation, bilayer, CG model

e. Determination of plasticizer efficiency for nylon by molecular modeling

Dafna Knani and David Alperstein (Department of Mechanical Engineering)

Plasticizer efficiency is known to be greatly influenced by the structural effects of the plasticizer and the nature of the polymer. In our research, these factors are explored through systematic examination. Based on preliminary results, a homology series of plasticizers has been explored, for example, esters of 4-hydroxybenzoate, with various chain lengths of the alcohol moiety. Further, the efficiency of linear plasticizers has been compared to that of branched plasticizers and between-stereoisomer plasticizers. Plasticizers are determined by calculating cohesive energy density (CED), solubility parameters, free volume and interaction intensities of pristine nylon and nylon–plasticizer blends.

Keywords: Molecular modeling, plasticizer efficiency, POSS nanocomposites, polyester crosslinking, organogelator

Additional research projects:

- Analysis of the migration of POSS-based nanocomposites in polypropylene by molecular modeling
- Investigation of peroxide crosslinking of styrene-free unsaturated polyester alkyd
- Computational study of the interaction of carbon nanotubes (CNTs) with various molecules that may serve as surfactants used for improving CNT dispersion in aqueous media
- In-slico study of the interactions among various organogelator molecules in a polymer matrix
- Molecular modeling of charged biopolymer interactions. The interactions between two biopoymers —gelatin (positively charged) and chondroitin sulphate (negatively charged)—in aqueous media are investigated.

ETHICAL IMPLICATIONS OF INNOVATIVE (BIO)-TECHNOLOGIES – DIGITAL PILLS AS AN EXAMPLE

Ilana Kepten

In September 2015, the FDA accepted the first new drug application (NDA) for a Digital Medicine product. The product is an original combination of a drug (Abilify, an approved drug to treat schizophrenia) and a signal generating ingestible device (the Proteus Digital Health Ingestible Sensor) encapsulated into a single pill. Upon reaching human stomach acidity conditions, the pill simultaneously supplies the medication and generates a signal that attests to the patient's intake of the drug. A patch worn by the patient and a "smartphone" facilitate immediate information transfer to a faraway recipient.

The combination pill will potentially promote patient's adherence to pharmaceutical treatment as well as simplify clinical trials with new drugs. In addition, users of the Digital Pill will generate data that would help physicians and pharmaceutical companies better monitor patient behavior. Nevertheless, this data collection method could lead to ethical difficulties that must be considered before future products are widely approved. In order to carry out such a discussion, we designed a hypothetically enhanced product. Based on the literature, we proposed an

advanced wearable patch as a collection tool, and an ingestible device that signals multiple times per intake. Such an imaginative yet plausible prototype will generate continuous, multi-parametric (physiological, behavioral etc.) data from each patient with every pill ingested. Such a large body of information highlights the ethical and regulatory issues of information ownership, privacy, medical confidentiality etc.

This hypothetical continuous data-generating product also underscores challenges to some of the very basic, bio-ethical concepts we currently hold. These challenges should be discussed by all the stakeholders before the emergence of the next generation of Digital Medicine products.

Keywords: Innovative technologies, bioethics, digital pill

DESIGN AND MANIPULATIONS OF NANOPARTICLES

Iris S. Weitz

Functionalized nanoparticulate systems are used for a variety of medical and pharmaceutical applications, as they are considered ideal carriers for drug delivery and diagnostic agents. In my research laboratory at the Department of Biotechnology Engineering at ORT Braude College, I combine broad-based knowledge of synthetic organic chemistry with nanotechnology tools to manipulate materials and their properties at the nanoscale level for therapeutic purposes.

My current research activities focus on the following areas:

- Contrast agents for multimodality medical imaging based on copper oxide core and organic shell nanoparticles in collaboration with Prof. H. Azhari from the Department of Biomedical Engineering at the Technion. This research has the potential to impact a variety of fields, including early cancer detection, leading to a new class of multifunctional nano-theranostic systems.
- Antifungal treatments utilizing copper oxide nanoparticles in collaboration with Prof. E. Segal from the Faculty of Biotechnology and Food Engineering at the Technion and Dr. M. Maoz (ORT Braude College).
- Assembly processes of metallic nanoparticles using biocompatible organic ligands. This research includes controlling the interactions between the nanoparticles by varying the proximity surrounding them and enabling the production of stable and ordered nanoparticles arrays.

Keywords: Nanoparticles, colloids, surface chemistry, functionalization, nanomedicine

STRATERGIES FOR NANOENCAPSULATION OF DRUG-CONJUGATED-COPPER OXIDE IN PLGA FOR IMAGING AND CONTROLLED DELIVERY

Iris S. Weitz and **Sarit Sivan**

Biodegrabale polymeric nanocarriers such as poly-lactic-co-glycolic acid (PLGA) are widely used as packing material for control delivery of drugs and for extending their circulation time.

Our main goal is to produce PLGA capsules contained drug conjugated CuO nanoparticles for imaging and drug delivery purposes. This copolymer can both protect the drug particulates and release them in a timed and sustained manner according to the polymer biodegradation pattern. The capability of such vehicles to seerve as imaging tools and to affect cancer cells is studied.

Keywords: Drug delivery, Polymers, Cancer, Nanoparticles, Emulsion, Ultrasound, MRI

EFFECT OF NANOPARTICLES ON HYPERCHOLESTEROLEMIA

Maria Grozovski and **Iris S. Weitz**

Hypercholesterolemia is a condition characterized by high levels of cholesterol in the blood that can cause plaque to form and build up, leading to blockages in the arteries that increase the risk of heart attack, stroke, circulation problems and death. Dietary lowering of cholesterol has very little effect on cholesterol levels. The use of statins, a family of drugs that inhibit HMG CoA reductase involved in biosynthesis, can help lower blood cholesterol. Statins, however, may also have side effects such as elevation of liver enzymes, gastrointestinal effects, headaches and muscle pains.

Our group has developed an experimental model of hypercholesterolemia in rats. The current research model is being used to develop a novel methodology of nanoparticle-based drug delivery to overcome the problems associated with statin drugs. Water soluble NPs are used for direct functionalization with pravastatin by self-assembly. The functionalized colloidal systems are characterized by such methods as UV spectroscopy and Cryogenic Transmission Electron Microscopy (TEM).

The research evaluates the following parameters: liver histology, hepatic and plasma lipid content, antioxidant levels, oxidative stress parameters, toxicology tests such as alkaline phosphatase (ALP), aspartate aminotransferase (AST), alanine aminotransferase (ALT) and gamma-glutamyltransferase (GGT), heart and hepatic profile.

Keywords: Nanoparticles, nanotoxicology, drug delivery, hypercholesterolemia

METABOLIC SYNDROME, OBESITY AND COGNITIVE DYSFUNCTION

Maria Grozovski and **Nimer Assy** (The Ziv Medical Center)

The metabolic syndrome (MS) is supposed to play a relevant role in the pathogenesis of obesity and may be associated with cognitive impairment. Accordingly, much research attention has focused on the association between MS and cognitive impairment in metabolically healthy obese (MHO) and metabolically unhealthy obese (MAO) individuals.

The research involves investigation of lipid metabolism, lipid peroxidation, enzymatic and non-enzymatic antioxidants, CRP and insulin resistance (HOMA).

Keywords: Metabolic syndrome, obesity, lipid metabolism, oxidative stress

NEURAL NETWORK BASED MODELING OF DRUG PERMEABILITY THROUGH THE BLOOD–BRAIN BARRIER

Idit Golani and **Mati Golani** (Department of Software Engineering)

The pharmaceutical industry is increasingly interested in grappling with the challenge of predicting properties such as absorption, distribution, metabolism and excretion (ADME) of central nervous system medications. Blood–brain barrier (BBB) permeability is an important ADME property and plays a major role in drug design. The experimental determination of BBB permeation is often complex and time-consuming. For modeling purposes, however, data sets of BBB permeation can be derived from databases of known drugs. In this research, a neural network is developed to learn the "sense" of the pharmacokinetic properties of known drugs and to use this data to predict the permeation of newly designed drugs.

Keywords: Schizophrenia, blood–brain barrier, central nervous system, antipsychotics, drug delivery, neural network

NEUROPHARMACOLOGY

Idit Golani and **Alon Shamir** (Mazra Mental Health Center)

Genetic and functional evidence of the involvement of NRG1 and ErbB4 receptors in the etiology of schizophrenia is accumulating. The main research objective is to explore the effect of pharmacological inhibition of the ErbB4 signaling pathway on behaviors relevant to the core symptoms of schizophrenia in adolescent and young adult mice.

Keywords: Schizophrenia, blood–brain barrier, central nervous system, antipsychotics, drug delivery, neural network

FATE AND TRANSPORT OF NANOMATERIALS AND THEIR EFFECT ON BIOAVAILABILITY OF HOCS IN SOIL–WATER SYSTEMS

Isam Sabbah

The objective of this research is to determine the points at which engineered particles are released into the environment as well as the physical and chemical properties controlling the transport and transformation of these nanomaterials and associated pollutants in environmental media. Such studies are becoming very relevant due to the increasing implementation of wastewater recycling, irrigation with marginal waters and the like. The research involves characterizing the size, electrical charge/pH relationships, surface chemistry and hydraulic properties of natural and engineered NPs. Moreover, new modeling approaches are proposed to help understand the impact of strong nonlinear sorption on rates of desorption and hence on the bioavailability of contaminants associated with NPs to better predict environmental impacts.

The results of this study will specify the fundamental physicochemical behavior of nanoparticles

(NPs) on the transport, fate and bioavailability of hydrophobic organic compounds (HOCs) in soil–water systems related to seepage and groundwater contamination. This information is extremely important for assessing environmental risk, and will be used by regulatory authorities to assess global change issues in Israel and beyond.

Keywords: NP, bioavailability, adsorption, groundwater

DEVELOPMENT OF VISIBLE LIGHT-MODIFIED HYBRID PHOTOCATALYTIC-ADSORPTION PROCESS FOR EFFICIENT DISINFECTION OF WATER AND WASTEWATER

Isam Sabbah

The overall goal of this project is to develop an innovative low cost and sustainable disinfection technology based on heterogeneousphoto-catalysis activated by visible light. Beyond the proposed application, the future plan is to explore the use of this material platform as a visible-light-driven photo-catalyst for enhancing the removal of residual organic material at very low-concentrations from drinking water systems.

Keywords: Photcatalysis, water, organic matter, adsorption, disinfection

ENDOPHYTIC BACTERIA IN AGRICULTURE

Lilach Iasur Kruh

In recent years, there has been growing public pressure toward the use of "green products" in agriculture because of the negative impact of chemical spraying on the environment and the emergence of pesticide resistance. One environmental friendly solution is microbial biocontrol agents.

The internal tissues of most plants are naturally inhabited by endophytic bacteria that do not harm their hosts. These bacteria often play a major role in numerous aspects of their host plant's biology. Cases showing a mutual host–bacterium benefit include enhanced host growth rate, acceleration of seed germination, tolerance to stress, and supply of critical nutrients to the host. Endophytic bacteria can also contribute to plant disease resistance by suppressing pathogens and enhancing the plant's immune system.

My research focuses on identification and isolation of endophytic bacteria that can be used as a biocontrol agent against plant diseases and/or as biostimulators for improving plant growth. Using both classical and molecular microbiology methods, the application of these bacteria will be calibrated and a suitable formulation will be manufactured in order to make it simple for farmers to use.

Keywords: Endophytic bacteria, bio-control, agriculture

SMALL MOLECULE INHIBITORS OF GLYCOSAMINOGLYCANS – A NOVEL CHEMICAL FAMILY OF INFLAMMATION INHIBITORS

Nicolas Harris

Heparan Sulfate (HS) is a linear polysaccharide found in all animal tissues. It occurs as a proteoglycan (HSPG) in which HS is attached to the cell surface and extra cellular matrix proteins. HSPG binds to a variety of protein ligands and regulates a wide range of biological activities including angiogenesis, blood coagulation and tumor metastasis. The HS of HSPG has also been shown to be a cellular receptor for a number of viruses. Rimonyx Pharmaceuticals (Israel), in collaboration with the Department of Biotechnology Engineering, ORT Braude College, has identified small molecule amphipathic amines that inhibit the in vitro binding of inflammatory proteins to HSPGs. The same compounds, active in mouse peritonitis, paw edema and delayed-type hypersensitivity, display anti-viral activity and are potential therapeutic inhibitors of inflammatory proteins. The in vitro and in vivo data provide a novel mechanism of action for the anti-inflammatory activity of small molecule amphipathic amines. The mechanism of action may account for the therapeutic activity of cationic acridines, phenothiazines and their congeners, chloroquine, quinine and tilorone that are used to treat malaria, viral diseases, cancer, rheumatoid arthritis and neuropsychiatric diseases. It is proposed that novel small molecule amphipathic amines be synthesized and tested in vitro and in animal disease models to elucidate the mechanism of action of these anti-inflammatory agents and develop a novel class of therapeutic agents.

Keywords: Glycosaminoglycans, heparin sulfate, inflammatory diseases, small molecule drugs

ANTIOXIDANT PROPERTIES OF STEVIA REBAUDIANA PLANT

Rivka Weiser Biton

The worldwide use of Stevia rebaudiane, as a substitute sweetener for sugar, increases every year. Stevia rebaudiane is not involved in the insulin mechanism and as so has no calories. This makes Stevia rebaudiane a natural substitute for the more common synthetic substitutes for sugar.

Various studies show that the Stevia rebaudiane plant contains substances with antioxidant reagent properties, and as such can prevent antioxidation damage to DNA.

The aim of the project is to find optimal conditions for the process so that the antioxidants in the Stevia plant are preserved. Methods used for testing were redox-titrations and spectrophothometric methods.

In all results, Vitamin C was used as reference for the antioxidation activity. The results show that the Stevia rebaudiane plant is active as an antioxidant reagent, and that the extent of the antioxidant activity depends on the solvent and on the conditions of the extraction process.

Keywords: Stevia rebaudiane, natural substitue for sugar, extraction process, antioxidating activity, methods for testing.

DEVELOPMENT OF NEW ADJUVANTS

Rosa Azhari and **Ditza Levin**

Vaccine design is a major challenge in the battle against infectious diseases such as AIDS, hepatitis, tuberculosis and various influenza pandemics. The development of immunotherapy for cancer or autoimmune diseases based on the use of a vaccination approach is also a key line of research.

An effective vaccine is dependent on the inclusion of an adjuvant in addition to the specific immunizing pathogen or antigen. Very few adjuvants are available for human vaccines, and those available are limited in their potential to dictate the desired immune response.

This research investigates the development of an innovative generic adjuvant that will make it possible to direct the immune response to the protective type against a specific pathogen or pathogenic disease. This adjuvant is based on immuno-microspheres that are generated by a co-acervation process and are composed of a combination of different natural materials. The composition of these microspheres facilitates the encapsulation of antigens and immunomodulators, and allows the binding of targeting agents to the microspheres. The microspheres can target the antigen to professional antigen-presenting cells, which are crucial for initiating an efficient immune response and can dictate the type of response.

Keywords: Immunology, controlled release, targeting, microencapsulation

DRUG DELIVERY TO THE BRAIN

Rosa Azhari, Idit Golani and **Alon Shamir** (Mazra Mental Health Center)

The high selectivity of the blood–brain barrier (BBB) prevents up to 98% of all central nervous system (CNS) discovery compounds from reaching their targets in the brain, leading to greater concentration of drugs in peripheral tissues as well as side effects. Antipsychotic medications reduce the psychotic symptoms of schizophrenia and other mental illnesses. Newer antipsychotic drugs, such as Clozapine (Clozaril), and Olanzapine (Zyprexa), also lead to metabolic side effects such as weight gain, increased glucose and lipids, and even to severe side effects such as agranulocytosis. Novel drug delivery systems should enhance drug penetration to the CNS, reduce side effects and improve patient compliance. This research examines an approach for targeting these drugs to the CNS.

Keywords: Schizophrenia, blood–brain barrier, central nervous system, antipsychotics, drug delivery, neural network

TISSUE ENGINEERING OF SKELETAL MUSCLE UNDER MECHANICAL STIMULATION

Rosa Azhari and **Ehud Kroll**

Tissue engineering aims at generating bio-artificial tissue for replacing diseased, degenerated or damaged tissue. In tissue engineering, cells are seeded on synthetic or natural scaffolds that

provide a platform for cell proliferation and differentiation, and the constructs are then grown in bioreactors. One obstacle encountered in tissue engineering is the inability to obtain functional bio-artificial tissue, with structural hierarchy and biomechanical properties identical to those of the native tissue.

Previous studies have demonstrated that the mechanical environment plays a critical role in tissue development, especially for those tissues that operate in mechanically challenging physiological settings. This research studies the effects of mechanical stimulation on skeletal muscle tissue development and organization and on the properties of the engineered muscle tissue. Hybrid mats, produced by electrospinning, are used as scaffolds for growing skeletal muscle tissue in a bioreactor containing a stretching device. The device can be programmed to apply various stretching patterns on the constructs during tissue development in the bioreactor.

Keywords: Skeletal muscle, tissue engineering, mechanotransduction, electrospinning

PREECLAMPSIA: EXOSOMES AND GALECTINS

Marei Sammar

Preeclampsia affects 2-7% of pregnancies and is a major cause of maternal and fetal mortality and morbidity. This hypertensive disorder develops from mid-gestation and may exacerbate into eclampsia, characterized by brain convulsions and stroke. The only effective cure is to deliver the baby. Although placentation failure is anticipated, the etiology is still unknown, and preeclampsia remains the "disease of theories".

Early studies revealed that the serum galectin-13 serves as a prediction biomarker for preeclampsia, based on its low level in the first trimester of pregnancy. Decreased galectin-13 mRNA has also been identified in the first trimester. Although soluble galectin-13 can be detected in maternal and fetal blood and in the amniotic fluid, the biological relationship between preeclampsia and galectin-13 is not understood. Our hypothesis is that galectin-13 resides in placental-derived exosomes and may deliver the "danger signals" or "rescue signals" at the placentation phase of early pregnancy. An ex vivo dual placental lobe perfusion model was used to prepare and isolate syncytotrophoblast extracellular vesicles (STBEVs) from normal term and preeclamptic placentas using sequential centrifugation and filtration. New findings support the notion that galectin-13 is part of the proteomic cargo of two populations of placental STBEVs: STB enriched microvesicles (STBMVs) and STB enrich exosomes (STBEX).

The galectin-13 levels in STBMVs and STBEXs were significantly lower in preeclampsia compared to normal controls. Vesicular galectin-13 is localized both inside the STBEVs and at the surface of STBEVS. The distribution of vesicular galectin-13 might be affected by pathological conditions. The current research aims to quantify galectin-13 levels in placental-derived STBEVs in the plasma and amniotic fluids of preeclamptic women during pregnancy and evaluate its potential to serve as a diagnostic / prognostic marker for preeclampsia.

Keywords: Preeclampsia, galectin-13, exosomes, placenta, biomarkers

TISSUE ENGINEERING OF INTERVERTEBRAL DISC

Sarit Sivan and **Michal Amit**

Disc degeneration and accompanying low back pain (LBP) impose a major medical and societal cost. The normal functioning of an intervertebral disc (IVD) is governed by its major macromolecular constituents— collagen, and the large aggregating proteoglycan (PG)— aggrecan, distributed across the central gelatinous nucleus pulposus (NP) and the outer annulus fibrosus. Aggrecan, apart from its role in imbibing water and distributing loads, also inhibits ingrowth of both nerve and endothelial cells. With the onset of disc degeneration, PG is lost from the disc's inner regions, resulting in water loss and concomitant loss of disc height. Increased innervation and vascularization, which are related to the development of 'discogenic' LBP, have also been reported. An IVD can potentially trigger self-healing due to the presence of progenitor cells, specifically notochordal cells, which participate in disc development. With the onset of disc degeneration, NP cells produce less extracellular matrix (ECM), which limits disc regeneration potential. The activity of NP cells, however, can be regained by co-culturing them with mesenchymal stem cells (MSCs).

The main goals of our study are to test the capability of a novel series of biomimetic GAG analogues, developed by Sivan et al., to function as BM-MSC carriers and to promote the production of NP-like ECM via cues delivered to the cells by their unique structural characteristics. Accordingly, BM-MSCs will be cultured in GAG analogue hydrogels of different stiffnesses. Constructs will be incubated under IVD-like conditions of osmolarity in the presence and absence of differentiation factors. They will be tested for tissue organization and assessed for cell viability, biochemical composition and the presence of NP-phenotype markers using gene expression. The ability of GAG analogues to delay nerve growth will also be assessed.

IRON ROLE IN WASTEWATER REMEDIATION

Sivan Klass

Iron chemistry holds potential for various applications in water and wastewater remediation. My research focuses on different roles that iron may have in facilitating the removal of contaminants such as metals, nutrients and organic matter from wastewater and intensive aquaculture waters.

Keywords: Iron, wastewater remediation

REFEREED PAPERS

S. Gizurarson, E. Sigurdardottir, H. Meiri, B. Huppertz, M. Sammar, A. Sharabi-Nov, M. Mandalá and **G. Osol**, Placental protein 13 (PP13) administration to pregnant rats lowers blood pressure and augments fetal growth and venous remodeling. *Fetal Diagnosis and Therapy*, *39*(1), 56-63, 2016. doi:10.1159/000381914. Epub 2015 Aug 28

D. Knani, D. Alperstein, T. Kauth, D. Kaltbeitzel and **C. Hopmann**, Molecular modeling study of CO2 plasticization and sorption onto absorbable polyesters**.** *Polymer Bulletin*, *72*(6), 1467-1486, 2015.

O. Perlman, I. Weitz and **H. Azhari**, Copper oxide nanoparticles as contrast agents for MRI and ultrasound dual-modality imaging. *Physics in Medicine and Biology*, *60*, 5767-5783, 2015**.**

I. Weitz, M. Maoz , D. Panitz, E. Eichler and **E. Segal**, Combination of CuO nanoparticles and fluconazole: Preparation, characterization, and antifungal activity against Candida albicans. *Journal of Nanoparticle Research*, *17*(342), 1-9, 2015.

M. Yáñez-Mó, P. Siljander, Z. Andreu, B. Zavec, E. Borràs, E. Buzas, K. Buzas, E. Casal, F. Cappello, **M**. **Sammar, F. Sánchez-Madrid, et al. ...** Biological properties of extracellular vesicles and their physiological functions, *Journal of Extracellular Vesicles*, May 14;4:27066, 2015. doi: 10.3402/jev.v4.27066. eCollection 2015

M. Brayda-Bruno, M. Tibiletti, K. Ito, J. Fairbank, F. Galbusera, A. Zerbi, S. Roberts, E. Wachtel, Y. Merkher and **S. Sivan**, Advances in the diagnosis of degenerated discs and their possible clinical applications, *European Spine Journal*, *3*, 315-23, 2014.

M. Kivovich, I. Tzchori, M. Falah, M. Flugelman, N. Lanir, R. Beyar, N. Lotan and **S. Sivan**, The formation of an anti-restenotic/anti thrombotic surface by immobilization of nitric oxide synthase. *Acta Biomater*, *10*(5), 2304–2312, 2014.

N. Harris, F.Y. Kogan, G. Il'kova, S Juhas, O. Lahmy, Y.I. Gregor, J. Koppel, R. Zhuk and **P. Gregor,** Small molecule inhibitors of protein interaction with glycosaminoglycans (SMIGs), a novel class of bioactive agents with anti-inflammatory properties. *Biochimica et Biophysica Acta*, *1840*, 245-254, 2014.

D. Knani and **D. Alperstein**, Toward computational design of efficient plasticizers for nylon. *Polymers for Advanced Technologies*, *25*(3), 307-313, 2014.

D. Knani, D. Alperstein, N. Borchmann, M. Spekowius and **C. Hopmann**, Prediction of environmental stress cracking in polycarbonate by molecular modeling. *Polymers for Advanced Technologies*, *25* ,1433–1438, 2014.

M. Sammar, S. Nisemblat, R. Gonen, B. Huppertz, S. Gizurarson, G. Osol and **H. Meiri,** The role of the carbohydrate recognition domain of placental protein 13 (PP13) in pregnancy evaluated with recombinant PP13 and the DelT221 PP13 variant. *PLoS One*, 31;9(7):e102832, 2014.

S. Siva, A. Hayes, E. Wachtel, B. Caterson, Y. Merkher, S. Brown, A. Maroudas and **S. Roberts**, Biochemical composition and turnover of the extracellular matrix of the normal and degenerate intervertebral disc. *European Spine Journal*, *23*(3), 344-353, 2014.

S. Sivan, S. Roberts, J. Urban, J. Menage, J. Bramhill, D. Campbell, V. Franklin, F. Lydon, Y. Merkher, A. Maroudas and **B. Tighe**, Injectable hydrogels with high fixed charge density and swelling pressure for nucleus repair: Biomimetic glycosaminoglycan analogues. *Acta Biomaterialia*, *10*(3), 1124-1133, 2014.

S. Sivan, F. Wachtel and **P. Roughley**, Structure, function, ageing and turnover of aggrecan in the intervertebral disc. *Biochimica et Biophysica Acta*, *1840*(10), 3181-3189, 2014.

N. Than, A. Balogh, R. Romero, E. Karpati, O. Erez, A. Szilagyi, I. Kovalszky, M. Sammar, S. Gizurarson, J. Matko, P. Zavodszky, Z. Papp and **H. Meiri**, Placental protein 13 (PP13) – Placental immunoregulatory galectin protecting pregnancy. *Frontiers in Immunology, 5*, 348. doi: 10.3389/fimmu.2014.00348. eCollection 2014.

Z. Ackerman, M. Grozovski, M. Oron-Herman, T. Rosenthal, B.-A. Sela and **G. Amir**, Effect of antihypertensive and triglyceride lowering drugs on splenocyte apoptosis in rats with fatty liver. *Basic & Clinical Pharmacology & Toxicology, 113*(1), 37-42, 2013.

Z. Ackerman, O. Pappo, G. Link, M. Glazer and **M. Grozovski**, Liver toxicity of thioacetamide is increased by hepatocellular iron overload. *Biological Trace Element in Research*, *163*(1-2), 169-76, 2015.

Z. Ackerman, G. Skarzhinsky, M. Grozovski, M. Oron-Herman, T. Rosenthal and **B.-A. Sela**, Effects of antihypertensive and triglyceride lowering agents on hepatic copper concentration in rats with fructose induced fatty liver. *Basic & Clinical Pharmacology & Toxicology*, *115*(6), 545-51, 2014.

O. Boubriak, N. Watson, S. Sivan. N. Stubbens. R. Lee and **J. Urban**, Factors regulating viable cell density in the intervertebral disc: Blood supply in relation to disc height. *Journal of Anatomy, 222*(3):341-348, 2013.

N. Bretz, J. Ridinger, A. Rupp, K. Rimbach, S. Keller, C. Rupp, F. Marme, L. Umansky, V. Umansky, T. Eigenbrod, M. Sammar and **P. Altevogt**, Body fluid exosomes promote secretion of inflammatory cytokines in monocytic cells via TLR signaling. *Journal of Biological Chemistry*, *288*(51), 36691-702, 2013.

B. Huppertz, H. Meiri, S. Gizurarson, G. Osol and **M. Sammar**, Placental protein 13 (PP13): A new biological target shifting individualized risk assessment to personalized drug design combating preeclampsia. *Human Reproduction Update*, *19*(4), 391-405, 2013.

D. Knani and **D. Alperstein**, In silico studies of 1,3(R):2,4(S)-dibenzylidene-D-sorbitol as a gelator for polypropylene. *Polymers for Advanced Technologies*, *24*(4), 391–397, 2013.

H. Meiri, M. Sammar, A. Herzog, Y. Grimpel, G. Fihaman, A. Cohen, V. Kivity, A. Sharabi-Nov and **R. Gonen**, Prediction of preeclampsia by placental protein 13 and background risk factors

and its prevention by aspirin. *Journal of Perinatal Medicine, 42*(5), 591-601, 2014. doi: 10.1515/jpm-2013-0298.

N. Ne'eman, D. Marbach, L. Chen-Konak, K. Kaufman-Francis, M. Berkovich, S. Levenberg, N. Lotan and **S. Sivan**, Multi-factor, sequentially releasing scaffolds for tissue engineering: Fabrication by the novel solvent/non-solvent sintering technology. *Israel Journal of Chemistry*, *53*, 821-8, 2013.

S. Sivan, Y. Merkher, E. Wachtel, J. Urban, A. Lazary and **A. Maroudas**, A needle micro-osmometer for determination of glycosaminoglycan concentration in excised nucleus pulposus tissue. *European Spine Journal*, *22*(8),1765-73, 2013.

BOOKS AND CHAPTERS IN BOOKS

M. Golani and **I. Golani**, Neural Network Ensemble based QSAR Model for the BBB Challenge: a Review. Transactions on Engineering Technologies - World Congress on Engineering and Computer Science 2014. Springer 2015. ISBN:978-94-017-7235-8.

S. Dimartino, I. Lir, M. Haber and **R. Azhari**, Algal bio-adhesives for biomedical applications with particular reference to Gracilariaconferta extracts. In P. Flammang, ed., *Biological and Biomimetic Adhesives*, Royal Society of Chemistry, pp. 117-131, 2013.

REFEREED CONFERENCE PROCEEDINGS

O. Perlman, I. S. Weitz and **H. Azhari**, Preliminary study of copper oxide nanoparticles acoustic and magnetic properties for medical imaging. *Proceedings of SPIE 9412, Medical Imaging 2015: Physics of Medical Imaging*, 941204, 2015.

N. Assy, A. Abosaleh, H. Assly, M. Grosovski and **N. Bar Guy**, Fibro scan and cognitive dysfunction in obese individuals with metabolic risk factors. *Journal of Hepatology*, 62(Supplement 2), S730-731, 2015.

M. Golani and **I. Golani**, Neural net ensemble based QSAR modeler for drug blood brain barrier permeation, Lecture Notes in Engineering and Computer Science: Proceedings of The World Congress on Engineering and Computer Science 2014, WCECS 2014, 22-24 October, 2014, San Francisco, USA, pp 818-823. (Best Paper Award)

I. Kapnikov, R. Farah, M. Gibstein, A. Djibre, M. Grozovski and **N. Assy**, Non alcoholic fatty liver disease may induces portal hypertension without associated liver fibrosis. *Journal of Hepatology*, 60(Supplement 1), S335, May, 2014.

A. Shalata, Y. Vintfield, L. Krichevsky, S. Svzalb, M. Grosovski, A. Djibre and **N. Assy**, The effect of vitamin D and sitagliptin/metformin combination on hepatic fat and triglyceride content in MO-1 mice with fatty liver disease. *Journal of Hepatology*, 58(Supplement 1), S531, 2013

S. Gizurarson, H Meiri, B. Huppertz, M.Sammar and **G. Osol**, Placental protein 13 (PP13) shows beneficial effects on the maternal vasculature in pregnant rats: Potential benefits in preeclampsia and IUGR placenta. Placenta, 35(9), A 85, IFPA meeting, Paris, France, 9-12 September, 2014.

M. Sammar, **N. Bretz**, **J. Hazin** and **P. Altevogt**, Galectins as major components in amniotic fluid-derived exosomes. Third International Meeting of ISEV 2014 Rotterdam, The Netherlands, April 30–May 3, 2014. Journal of Extracellular Vesicles, 3, 10.3402/jev.v3.24214

M. Sammar, B. Huppertz, S. Gizurarson, H. Meiri and **G. Osol**, Placental protein 13: Characterization of a naturally occurring variant lacking the carbohydrate recognition domain. *Placenta*, 35(9): A 84, IFPA meeting, 9-12 Sepember, 2014, Paris, France.

A. Shalata, Y, Vintfield, L. Krichevsky, S. Svzalb, M. Grosovski, A. Djibre and **N. Assy**, The effect of vitamin D and sitaglibtin/metpormin combination on hepatic fat and triglyceride content in MO-1 mice with fatty liver disease. *International Liver Congress* (*ILC*), Amsterdam, The Netherlands, 9-13 April, 2013.

N. Bretz, J. Ridinger, A. Rupp, K.Rimbach, S. Keller, T. Eigenbrod, A. Dalpke, M. Sammar and **P. Altevogt**, Exosomes trigger NFBk and STAT3 activation via TLR signalling in monocytic THP-1 cells. *2nd International Meeting of ISEV 2013*, Boston, USA, 17-20 April, 2013.

M. Grozovski, O. Pappo, G. Link, K. Maya and **Z. Ackerman**, The effects of iron overload and iron deficiency in thioacetamide induced acute liver injury. *23rd Conference of the Asian Pacific Association for the Study of the Liver (APASL),* Singapore, Singapore, 6-10 June, 2013.

B. Huppertz, H. Meiri, S. Gizurarson, G. Osol and M. Sammar, Meta-analysis of studies using placental protein 13 (PP13) for first trimester screening for preeclampsia. SGI Summit *"From Implantation to Parturition"* New Frontiers in Women's Health, Jerusalem, Israel, 2013, 28-30 May, 2013.

ORAL PRESENTATION AT INTERNATIONAL CONFERENCES

L. Iasur-Kruh, V. Naor, S. Perlman, S. Rodoy and E. Zchori-Fein, Endophytic bacterium as possible control agents against phytoplasma in grapevine. *3rd Conference of the Israel Society for Biotechnology Engineering (ISBE)*, Tel Aviv, Israel, December 2015.

M. Grosovski, N. Bar Guy, and N. Assy, Impact of oxidative stress on cognitive dysfunction in obese individuals with metabolic risk factors. *11th ORT Braude College Interdisciplinary Research Conference*, Israel, October 2015.

A. Abo Saleh, **M. Grosovski**, N. Bar Guy and N. Assy, Fibro scan and cognitive dysfunction in obese individuals with (MAO) or without (MHO) metabolic risk factors. *The Annual Meeting of the Israeli Society for Research, Prevention and Treatment of the Liver Disease*, Eilat Israel, June 2015.

N. Assy, A. Abosaleh, H. Assly, **M. Grosovski** and N. Bar Guy, Fibro scan and cognitive dysfunction in obese individuals with metabolic risk factors. *50th Annual Meeting of the European Association for the Study of the Liver (EASL)*, Vienna, Austria, 22-26 April, 2015.

A. Abu Saleh, **M. Grozovski** and N. Assy, Cognitive dysfunction in obese individuals with or without metabolic risk factors. *65th Annual Meeting of American Association for the Study of the Liver (AASLD)*, Boston, USA, November, 2014.

M. Grozovski, R. Farah, M. Gibstein, A. Djibre, I. Kapnikov and N. Assy, Non alcoholic fatty liver disease may induces portal hypertension without associated liver fibrosis. *The Annual Meeting of the Israeli Society for Research, Prevention and Treatment of the Liver Disease*, Eilat, Israel, June, 2014.

I. Kapnikov, R. Farah, M. Gibstein, A. Djibre, **M. Grozovski** and N. Assy, Non alcoholic fatty liver disease may induces portal hypertension without associated liver fibrosis. *49th International Liver Congress (EASL)*, London, United Kingdom, April, 2014.

R. Azhari, Mechanisms of polymer degradation and their modeling. *Workshop on Biodegradable Polymers in Medicine*, Jerusalem, Israel, September 2013.

E. Broide, A.G. Schauss, G. Ben-Yehudah, Y. Siman-Tov and **M.Grozovski**, Acai improves oxidative xtress and hepatic triglyceride accumulation in rat model with fatty liver. *Annual Meeting of American Association for the Study of the Liver (AASLD)*, Washington, November, 2013.

M. Grozovski, A.G. Schauss, G. Ben-Yehudah, Y. Siman-Tov and E. Broide, Effects of ACAI on oxidative stress and hepatic lipid profile in rats with non alcoholic fatty liver. *23rd Conference of the Asian Pacific Association for the Study of the Liver, (APASL),* Singapore, Singapore, 6-10 June, 2013.

A. Shalata, Y. Vintfield, L. Krichevsky, S. Svzalb, **M. Grosovski**, A. Djibre and N. Assy, The effect of vitamin D and sitaglibtin/metpormin combination on hepatic fat and triglyceride content in MO-1 mice with fatty liver disease. *International Liver Congress (ILC)*, Amsterdam, Netherlands, April, 2013.

NON REFEREED CONFERENCE PROCEEDINGS AND ABSTRACTS

D. Knani, H. Olami and **M. Zilberman**, Simulation of novel soy protein-based systems for tissue regeneration applications. *ORT Braude College 11th Interdisciplinary Research Conference*, Israel, October. 2015.

O. Perlman, I. Weitz, and **H.Azhari**, Investigation of copper oxide nanoparticles as a dual imaging modality contrast agent for medical diagnosis. *ORT Braude College 11th Interdisciplinary Research Conference*, Upper Galilee, Israel, October. 2015.

M. Alagem, E. Kivovich, I. Tzchori, N. Lanir, M. Falah, M. Flugelman, U. Dinnar, R. Beyar, N. Lotan and **S. Sivan**, Bio-inspired implants for the treatment of restenosis. *ORT Braude College 10th Research Day*, Nahariya, October. 2014.

M. Grozovski, **E. Levanov** and **N. Assy**, Impact of oxidative stress on cognitive dysfunction in non-alcoholic fatty liver with or without metabolic syndrome. *ORT Braude College 10th Interdisciplinary Research Conference*, Nahariya, Israel, October. 2014.

R. Azhari, I. Bonshtein, G. Rechavi, J. Jacob-Hirsch, C. Gefen, N. Amariglio and **E. Kroll**, Profiling expression of structural and functional proteins in engineered muscle tissue following application of various stretching regimes. *2nd BIRAX Regenerative Medicine Conference*, Haifa, Israel, 2014 (refereed poster).

D. Knani, Simulation of bilayer systems based on neutral and cationic lipids in combination with fluorescent lipids. *9th Annual Meeting of the Israeli Chapter of The Controlled Release Society*, Maalot, Israel, 9-11 September, 2014. Chairperson of a session in the conference.

R. Azhari, I. Bonshtein and **E. Kroll**, Mechanisms of skeletal muscle cell mechanotransduction. *ORT Braude College 9th Interdisciplinary Research Conference*, Upper Galilee, Israel, 2-3 October, 2013.

D. Knani, Molecular modeling of enzyme-catalyzed polyesterification. *2nd Conference of the Israel Society for Biotechnology Engineering (ISBE)*, Tel Aviv, Israel, December, 2013.

D. Knani and **D. Alperstein**, In silico studies of 1,3:2,4-dibenzylidene-D-sorbitol as a gelator for polypropylene. *Multifunctional, Hybrid and Nanomaterials Conference (Hybrid Materials 2013)*, Sorrento, Italy, 3-7 March, 2013.

M. Maoz, D. Panitz, S. Eichler, E. Segal and **I. S. Weitz**, The antifungal efficacy of formulated copper oxide nanoparticles. *ORT Braude College 9th Interdisciplinary Research Conference*, Upper Galilee, Israel, 2-3 October, 2013.

M. Nagel, A. Heinz, S. Sivan, R. Pankau, R. Neubert and **C. Schmelzer**, Insights into the proline hydroxylation of elastin derived from different tissues and species. *7th Polish-German Symposium on Pharmaceutical Sciences*, Gdańsk, Poland, 24-25 May, 2013.

S. Sivan, S. Roberts, J. Urban, J. Menage, J. Bramhill, D. Campbell, V. Franklin, F. Lydon, Y. Merkher, A. Maroudas and **B. Tighe**, Injectable hydrogels with high fixed charge density and swelling pressure for nucleus repair: biomimetic glycosaminoglycan analogues. *2nd Conference of the Israel Society for Biotechnology Engineering (ISBE)*, Tel Aviv, Israel, December, 2013.

I. S. Weitz, M. Maoz, D. Panitz, S. Eichler and **E. Segal**, The antifungal effect of copper oxide nanoparticles on candida albicans. *2nd Conference of the Israel Society for Biotechnology Engineering*, Tel Aviv, Israel (poster), December, 2013.

GRANTS

H. Azhari (Coordinator and PI) and **I. S. Weitz (PI)** Ministry of Science, Technology & Space, Israel (MOST, grant no. 311876). Title of research: Investigation of Multimodal Imaging Methods of Nanoparticles for Early Detection of Cancer, 2014-2017.

D. Minz (Coordinator and PI), E. Zchori-Fein (PI) et al., and **L. Iasur Kruh (PI)** Chief Scientist Ministry of Agriculture and Rural Development (grant no. 20-13-0027)**.** Title of research: Development and on-farm application of microbial control agents for the advancement of Israeli agro-biotech industry.

JOURNAL REFEREE

M. Grozovski

2012 - 2016	Journal of Hepatology, September, 2012
2011 - 2016	Journal of Clinical and Experimental Pharmacology and Physiology

S. Sivan

2015 - present	Osteoarthritis and Cartilage
2013 - present	Advanced Drug Delivery Reviews
2013 - present	Israel Journal of Chemistry
2012 - present	Connective Tissue Research
2012 - present	Spine
2011 - present	Cartilage
2010 - present	Acta Biomaterialia
2007 - present	European Spine Journal

M. Sammar

2012 - present	Reproductive Sciences
2014 - present	Placenta
2015 - present	Pathology and Pathohistology
2016 - present	Experimental and Molecular Pathology

CONFERENCE REFEREE

S. Sivan

2015	10th World Biomaterial Congress (WBC2016)

INVITED TALKS

I. Golani and **M. Golani**, A biological computerized modeler for a biologic barrier. *19th Annual Meeting of The Israel Society for Biological Psychiatry*. Kibbutz Hagoshrim, Israel, 24-26 March, 2015.

I. Golani, H. Tadmor, A. Buonanno, I. Kremer and A. Shamir, Disruption of the ErbB signaling in adolescence increases striatal dopamine levels and affects learning and hedonic-like behavior in the adult mouse. *Genetics, Epigenetics and Environment in health and illness*. Western Galilee Hospital, Israel, 18 November, 2014.

S. Sivan, Bio-inspired, enzymatically active, anti-restenotic/anti-thrombotic carrier. *BIT's 5th World Gene Convention-2014 (WGC-2014)*, Theme: Olympic Campaign of New Biotechnology¸ Co-Chair: Path 6: Biocatalysis and biotransformation and scale up of bioprocesses, Haikou, China, November, 2014.

S. Sivan, Biomimetic approach to repair of cartilaginous tissues. Institute of Pharmacy, Biosciences, Martin Luther University, Halle-Wittenberg, Germany, May, 2013.

S. Sivan, Structure, degeneration and repair of intervertebral disc. Department of Biomedical Engineering, Technion, Israel, March, 2013.

Department of Electrical & Electronic Engineering

Prof. Eduard Eitelberg, LL.D.,
Head of the Department

RESEARCH AREAS

CONTROL ENGINEERING

Eduard Eitelberg

Digital control: 'velocity' algorithms and industrial applications. Monetary and fiscal feedback control in national economies.

Keywords: Control, algorithm, monetary policy, fiscal policy

NANOELECTRONIC COMPUTER ARCHITECTURE

Michael Gladshtein

Design of non-traditional approaches to nanocomputer implementation on quantum-dot cellular automata.

Keywords: Nanocomputer, quantum-dot cellular automata, serial decimal processing, Johnson-Mobius code

POWER QUALITY OF SUPPLY

Daniel Kotek

In recent years, as the standard of living increases, and dependency on a reliable and continuous supply of electricity grows, Power Quality (PQ) assessment and improvement has been attracting increasing attention. Because of the increased usage of electronic equipment in industrial and

commercial sectors, the cost of damages caused by PQ events has become significantly higher than in the past. One research project focuses on voltage dips and short interruptions, which are known to be the most important aspects of power quality, and the main reasons for customer complaints. In my research, I analyzed the main causes of disturbances, and identified several ways of improving the power quality of the supply. Another important aspect of power quality is the harmonic content of the voltage and the current. Harmonics can be generated both by consumers and by the utility, and hence it is not easy to determine who is, in fact, responsible for them. Consequently, an ongoing research into this question is being conducted. A third research focuses on harmonic trends over the past several years. It is believed that the harmonic content of the voltage is increasing due to the increased share of power electronics.

Keywords: Power Quality, dips and short interruptions, harmonics

ELECTRIC TRANSPORTATION

Daniel Kotek

Our main research goal here is to increase the usage of electric transportation (trains, cars) in Israel by electrification of the vehicle fleet. The research studies the impact of different electric vehicle penetration scenarios on the performance of the power distribution and generation systems. An additional focus of the project is on pollution emissions due to the charging of electric vehicle batteries.

Keywords: Electric vehicles, pollution

SIGNAL AND IMAGE PROCESSING & COMPUTER VISION AND TEACHING APPLICATIONS

Evgeny Gershikov

One area of research focuses on machine control using voice based on speech recognition or hand gestures based on motion recognition. Another area of research considers facial images and their processing in order to recognize expressions or facial movements as well as gender and racial origin. In addition to these two areas, optical character recognition (OCR) of both handwritten and printed letters is being examined.

Keywords: Signal processing, image processing, computer vision, teaching applications, pattern recognition, machine learning, speech recognition, face recognition, OCR

PHOTONIC DEVICES

Vladislav Shteeman

This research is focused on development of new analytical and numerical methods of analysis of advanced photonic micro-devices (so-called "photonic crystals"), such as phased laser arrays,

arrays of coupled waveguides and photonic crystal fibers (including "holey" fibers). We develop new analytical approaches, providing fast (100-1000 times faster than the most widespread techniques) and accurate analysis of photonic crystal devices. These methods include evaluation of array modes and photonic band structure. The research is conducted in collaboration with the Department of Electrical Engineering – Physical Electronics at Tel Aviv University and Laboratory of Physics of Nanostructures at Ecole Polytechnique Fédérale de Lausanne, Switzerland.

Keywords: Photonic crystals, coupled-mode theory

MICROWAVE AND ANTENNAS ENGINEERING, COMMUNICATION AND MEDICAL SYSTEMS

Albert Sabban

My research areas are microwave and antennas engineering, communication and medical systems and system engineering.
Over the years, I have contributed to state-of-the-art research on microstrip and printed antennas in diverse frequency bands and applications. I have published our research results in conferences, seminars, workshops, journals, books and book chapters in major publications in these areas. I worked on and developed advanced antennas for Body-Area-Networks (BAN), results that are crucial in development of life-saving and medical system assistance for the elderly—a very active area today. I am a leading antenna and microwave scientist in Israel. I worked at RAFAEL (Israel) for 32 years as a leading antenna and microwave scientist and project leader.

Keywords: Microwave and antennas engineering, communication and medical systems, small antennas

ELECTRICAL AND ELECTRONICS ENGINEERING EDUCATION – USING ANIMATION TO PROMOTE TEACHING

Nissim Sabag

This research investigates the use of animation to promote teaching of Bipolar Junction Transistor (BJT) functions. The research is conducted in collaboration with the Technion.

Keywords: Animation based learning, active learning, promote teaching

REFEREED PAPERS

A. Sabban, Compact wearable tunable printed antennas for medical applications. *Research in Health and Nutrition (RHN) Journal*, *3*, 14-19, 2015.

A. Sabban, Wideband RF modules and antennas at microwave and MM wave frequencies for communication applications. *International Journal of Modern Communication Technologies & Research*, *3*, 89-97, 2015.

A. Sabban, New wideband meta materials printed antennas for medical applications. *International Journal of Advance in Medical Science (AMS)*, *3*, 1-10, 2015.

A. Sabban, New compact wearable meta-material antennas. *Global Journal for Research and Analysis*, *4*, 268-271, 2015.

A. Gero, W. Zoabi and **N. Sabag**, Animation based learning of electronic devices. *Advances in Engineering Education*, *4*(1), 1-21, 2014.

E. Gershikov and **S. Kosolapov**. On image based fast feedback systems for academic evaluation. *International Journal of Signal Processing Systems*, 3(1), 19-24, 2014.

E. Gershikov and **S. Kosolapov**, Camera-based instant feedback systems. *International Journal of Advanced Computing*, *47*(1), 1463-1473, 2014.

M. Gladshtein, Delay-based processing-in-wire for design of QCA serial decimal arithmetic units. *ACM Journal on Emerging Technologies in Computing Systems*, *10*(2), Article 13, 2014.

S. Kosolapov, N. Sabag and **E. Gershikov**, Evaluation of two camera-based approaches for collecting student feedback. *Educational Alternatives*, *12*, 1173-1182, 2014.

S. Kosolapov, N. Sabag and **E. Gershikov**. Evaluation of two camera-based approaches for collecting student feedback. *Educational Alternatives*, *12*, 1173-1182, 2014. Published online 2 October 2014.

D. Pundak, N. Sabag and **E. Trotskovsky**, Accreditation of MOOCS. *European Journal of Open, Distance and E-Learning*, *16*(2), 116-128, 2014.

N. Sabag and **E. Raz**, Analysis of electrical and electronics students' obstacles in studying physics – Work in progress. *World Transactions on Engineering and Technology Education*, *12*(4), 655-660, 2014.

N. Sabag, E. Trotskovsky and **S. Waks**, Engineering design project as a reflection promoter. *European Journal of Engineering Education*, *39*(3), 309-324, 2014. DOI: 10.1080/03043797.2013.867312

A. Sabban, W band MEMS detection arrays. *International Journal of Modern Communication Technologies & Research*, *2*, 9-13, 2014.

E. Trotskovsky and **N. Sabag**, How do students misunderstand the concept of accuracy? – Work in progress. *World Transactions on Engineering and Technology Education*, *12*(4), 715-719, 2014.

E. Trotskovsky and **N. Sabag**, Internship project – Design in industry vs. research in academia – A case study. *Educational Alternatives*, *12*, 581-587, 2014. Published online 4 September 2014.

E. Trotskovsky, N. Sabag and **S. Waks**, One output function: Students' misconception in digital electronics – A case study. *Research in Science & Technological Education*, 1-12, 2014. DOI: 10.1080/02635143.2014.983468.

E. Trotskovsky, N. Sabag, S. Waks and **O. Hazzan**, Students' achievements in solving problems using models and their misunderstanding of models in electronics. *IEEE Transactions on Education*, PP(99), 1-6, 2014. DOI: 10.1109/TE.2014.2331918

E. Gershikov, Perceptually optimized coding of color images for band-limited information networks. *International Journal on Communications (IJC)*, *2*(2), 49-62, 2013.

E. Gershikov, Color image compression using demosaicing and optimized color spaces. *International Journal of Computer Science and Application (IJCSA)*, *2*(2), 27-33, 2013.

E. Gershikov, On a probabilistic approach to rate control for optimal color image compression and video transmission. *International Journal of Computational Engineering Research (IJCER)*, *3*(4), 85-98, 2013.

E. Gershikov. Optimized color transforms for image demosaicing. *International Journal of Computational Engineering Research (IJCER), 3*(3), 1-7, 2013.

E. Gershikov, T. Libe and **S. Kosolapov**, Horizon line detection in marine images: Which method to choose?. *International Journal On Advances in Intelligent Systems, 6*(1 and 2), 79-88, 2013.

M. Gladshtein, Design and simulation of novel adder/subtractors on quantum-dot cellular automata: Radical departure from boolean logic circuits. *Microelectronics Journal, 44*(6), 545-552, 2013.

I. Lifshitz, E. Gershikov and **B. Milgrom**, New methods for horizon line detection in infrared and visible sea images. *International Journal of Computational Engineering Research (IJCER), 3*(3), 226-233, 2013.

A. Sabban. New wideband printed antennas for medical applications. *IEEE Transactions on Antennas and Propagation, 61*(1), 84-91, 2013.

A. Sabban, Comprehensive study of printed antennas on human body for medical applications. *International Journal of Advance in Medical Science (AMS), 1*, 1-10, 2013.

E. Smith, V. Shteeman and **A. Hardy**, Analytical approximation for photonic array modes in one-dimensional photonic crystal devices. *Applied Optics, 52*(8), 1743 – 1751, 2013.

E. Trotskovsky, S. Waks, N. Sabag and **O. Hazzan**, Students' misunderstandings and misconceptions in engineering thinking. *International Journal of Engineering Education*, *29*(1), 1–12, 2013.

BOOKS AND CHAPTERS IN BOOKS

A. Sabban, *Low visibility antennas for communication systems*. UK: Taylor & Francis Group, 2015.

A. Sabban, *Microwave theory and transmission lines*. Israel: Saar Publication, 2014.

I. Lifshitz, E. Gershikov and **B. Milgrom**, New methods for horizon line detection and target marking in infrared and visible sea images. In: *Advancements in marine robotics*, pp. 334-348. Germany: Lap Lambert Academic Publishing, 2013.

A. Sabban, Wearable antennas. In: A.Kishk (Ed.), *Advancements in microstrip and printed antennas*, ISBN 980-953-307-543-8. Croatia: Intech 2013.

REFEREED CONFERENCE PROCEEDINGS

S. Kosolapov and **N, Sabag**, Cloud-based time-effective laboratory reports grading. *ICICTE International Conference on Information Communication Technologies in Education*, 360-367, Kos, Greece, 9–11 July, 2015.

I. Rave, E. Trotskovsky and **N. Sabag**, Mathematical vs. engineering understanding: Engineering students' perceptions (Work in progress). *International Conference on Engineering Education ICEE*, Zagreb, Croatia, July, 2015.

N. Sabag and **E. Trotskovsky**, Characteristics of BSc students vs. practical engineering students performing final projects in electronics – The supervisors' point of view. *International Conference on Engineering Education ICEE*, Zagreb, Croatia. July, 2015.

A. Sabban, Dually polarized tunable printed antennas for medical applications. *IEEE European Antennas and Propagation Conference*, *EUCAP 2015*, Lisbon, Portugal, April, 2015.

E. Trotskovsky and **N. Sabag**, How do electric engineering students understand the accuracy concept concerning digitized signals. *International Conference on Engineering Education ICEE*, Zagreb, Croatia, July, 2015.

L. Giladi, E. Smith, V. Shteeman, E. Kapon and **A. Hardy**, Coupled-mode analysis of holey photonic crystals. *2014 IEEE 28th Convention of Electrical and Electronics Engineers in Israel (English)*, Eilat, Israel, 1-5 December, 2014. Best student paper award.

S. Kosolapov, N. Sabbag and **E. Gershikov**. Evaluation of two camera-based approaches for collecting student feedback. *5th International Conference on Education, Research and Development (ERD)*, Elenite, Bulgaria, 4–8 September 2014.

N. Sabag and **E. Trotskovsky**, Matching instructional strategies to learning styles: Does it contribute to students' achievements?. *ICEE/ ICIT 2014, Joint International Conference on Engineering Education & International Conference on Information Technology*, 134-142, Riga, Latvia, 2–6 June, 2014**.**

A. Sabban, New microstrip meta materials antennas. *IEEE Antennas and Propagation*, Memphis, TN, USA, July, 2014.

E. Smith, L. Giladi, V. Shteeman, E. Kapon and **A. Hardy**, Analytical approximation for photonic array modes in large 1D photonic crystal devices, *2014 IEEE 28th Convention of Electrical and Electronics Engineers in Israel* (English), Eilat, Israel, 1-5 December, Israel, 2014.

E. Trotskovsky and **N. Sabag**, Internship project – Design in industry vs. research in academia – A case study. *5th International Conference on Education, Research & Development (ERD)*, Elenite, Bulgaria, 4–8 September, 2014.

E. Trotskovsky and **N. Sabag**, Students' misconception of accuracy. ICEE/ ICIT 2014, *Joint International Conference on Engineering Education & International Conference on Information Technology*, 148-154, Riga, Latvia, 2–6 June, 2014.

E. Gershikov and **S. Kosolapov**, Reliability evaluation of 2D barcode OCR by using monte-carlo simulation. *ASMDA 2013*, Barcelona, Spain, June, 2013.

S. Kosolapov, E. Gershikov and **N. Sabag**, Feasibility of a camera-based instant feedback system. *5th International Conference on Creative Content Technologies*, Valencia, Spain, May 2013.

N. Sabag and **E. Trotskovsky**, Using lab experiments in electric circuits to promote achievements in mathematics. *EDUCON*, 123-129, Berlin, Germany, 2013.

N. Sabag, E. Trotskovsky and **S. Waks**, Misconceptions in electronics design using simulation. *ICEER International Conference on Engineering Education and Research*, Marrakesh, Morocco, 1-5 July, 2013.

A. Sabban, Wearable antennas for medical applications. *IEEE BodyNet*, 1-7, Boston, MA, USA, October, 2013.

A. Sabba, New meta materials antennas. *IEEE Antennas and Propagation*, Orlando, FL, USA, July, 2013.

E. Trotskovsky, N. Sabag, S. Waks and **O. Hazzan**, Students' misunderstandings in project design activities in electronics. *ICEER International Conference on Engineering Education and Research,* Marrakesh, Morocco, 1-5 July, 2013.

ORAL PRESENTATION AT INTERNATIONAL CONFERENCES

N. Sabag and E. Raz, Analysis of electrical and electronics students' obstacles in studying physics – Work in progress, *6th WIETE Annual Conference on Engineering and Technology Education*, March, 2015.

N. Sabag and E. Trotskovsky, Characteristics of BSc students vs. practical engineering students performing final projects in electronics – The supervisors' point of view. *International Conference on Engineering Education ICEE*, Zagreb, Croatia. July, 2015.

A. Sabban, Dually polarized tunable printed antennas for medical applications. *IEEE European Antennas and Propagation Conference, EUCAP 2015*, Lisbon, Portugal, April, 2015.

E. Gershikov, Is color important for horizon line detection?. *International Conference on Advanced Technologies for Communications (ATC)*, Hanoi, Vietnam, 15-17 October, 2014.

L. Giladi, E. Smith, V. Shteeman, E. Kapon and A. Hardy, Coupled-mode analysis of holey photonic crystals. *IEEE 28th Convention of Electrical and Electronics Engineers in Israel (English)*, Eilat, Israel 3-5 December, 2014. (Best student paper award.)

S. Kosolapov, **N. Sabbag** and E. Gershikov, Evaluation of two camera-based approaches for collecting student feedback. *5th International Conference on Education, Research & Development*, Elenite, Bulgaria, 4–8 September, 2014.

A. Sabban, New microstrip meta materials antennas. *IEEE Antennas and Propagation*, Memphis, TN, USA, July, 2014.

N. Sabag and E. Trotskovsky, Matching instructional strategies to learning styles: Does it contribute to students' achievements?. *ICEE/ICIT 2014, Joint International Conference on Engineering Education & International Conference on Information Technology*, Riga, Latvia, 2–6 June, 2014.

E. Smith, L. Giladi**, V. Shteeman,** E. Kapon and A. Hardy, Analytical approximation for photonic array modes in large 1D photonic crystal devices, *IEEE 28th Convention of Electrical and Electronics Engineers in Israel* (English), Eilat, Israel 3-5 December, 2014.

Y. Amoyal and **E. Gershikov**, Automatic smile and blur detection for still images. *International Conference on Advances in Computer and Electronics Technology (ACET) 2013*, Hong Kong, China, August, 2013.

I. Lifshitz and **E. Gershikov**, New methods for horizon line detection in infrared and visible sea images. *EMS 2013*, Budapest, Hungary, July 2013.

A. Sabban, Wearable antennas for medical applications. *IEEE BodyNet* 2013, Boston, MA, USA, October, 2013.

A. Sabban, New meta materials antennas. *IEEE Antennas and Propagation*, Orlando, FL, USA, July, 2013.

N. Sabag and E. Trotskovsky, Misconceptions in electronics design using simulation. *ICEER, International Conference on Engineering Education and Research*, Marrakesh, Morocco, 1-5 July, 2013.

N. Sabag and E. Trotskovsky, Using lab experiments in electric circuits to promote achievements in mathematics. *EDUCON*, Berlin, Germany, March, 2013.

NON REFEREED CONFERENCE PROCEEDINGS AND ABSTRACTS

D. Pundak, N. Sabag and **E. Trotskovsky**, Local online course versus MOOC. *11th ORT Braude College Interdisciplinary Research Conferenc*e, October, 2015.

N. Sabag and **E. Raz**, Analysis of electrical and electronics students' obstacles in studying physics – Work in progress. *11th ORT Braude College Interdisciplinary Research Conference*, October, 2015.

N. Sabag and **E. Raz**, Analysis of Electrical and electronics students' obstacles in studying physics – Work in progress. *5th Conference on Initiatives to Promote Learning in Higher Education*, ORT Braude College, May, 2015.

N. Sabag and **E. Trotskovsky**, Matching instructional strategies to learning styles: Does it contribute to students' achievements?. *10th ORT Braude College Interdisciplinary Research Conference*, 2014.

M. Gladshtein, Quantum-dot cellular automata serial decimal subtractors. *9th ORT Braude College Interdisciplinary Research Conference*, 2-3 October, 2013, Abstracts, p. 18.

OTHER PUBLICATIONS

N. Sabag and **E. Trotskovsky**, Misconceptions in electronics design using simulation. *MoreTech Journal of National Center of Technology Teachers*, 10, 6-9, July, 2015 (Hebrew).

A. Gero, W. Zoabi and **N. Sabag**, Computerized animation to improve achievements and attitudes of practical engineering the students towards electronics. *MoreTech Journal of National Center of Technology Teachers*, 35–39, March 2013. (Hebrew)

INVITED TALKS

A. Sabban, Wearable antennas. Memphis, TN, USA, July, 2014. Half-day course.

A. Sabban, Wearable antennas. Orlando, FL, USA, July, 2013. Half-day course.

A. Sabban, Wide band RF technologies and antennas at microwave and mm frequencies. Germany, October, 2013. Half-day course.

Department of Industrial Engineering & Management

Dr. Boris Shnits, Ph.D.,
Head of the Department

RESEARCH AREAS

A FRAMEWORK FOR ANALYZING MALPRACTICE CASES TO IMPROVE HEALTHCARE SYSTEMS

Shuki Dror and **Dina Margol**

This study develops a framework for analyzing the judgments handed down by courts in malpractice cases. We analyzed 215 cases handled by Israeli courts from 2005 to 2011 that involved awards for damages caused by medical negligence. The Pareto principle coupled with the mean square error criterion supports the selection of the vital hospital departments and the vital causes of claims. A quality function deployment matrix was used to translate the desired improvement in malpractice costs into relevant medical decisions and diagnostic tests. Based on the analysis, we can conclude that the essential part of all malpractice claims submitted to and found legitimate by the courts was related to the obstetrics field. We reveal that most claims have some elements in common. When we based the analysis on the malpractice compensation, covering costs of corrective treatment, suffering, future medical treatment, and associated legal fees, based on court data, we found that the group of vital causes decreased. In this study, we analyze claims related to the obstetrics department. Other departments where errors are frequently made should be addressed in turn, with the objective of continuously improving the medical system.

Keywords: QFD, MSE, pareto, medical errors, malpractice, healthcare

HOUSE OF SECURITY: A STRUCTURED SYSTEM DESIGN & ANALYSIS APPROACH

Shuki Dror, **Emil Bashkansky** and **Rachel Ravid**

Security managers must always be prepared to prevent terrorist and criminal attacks against their organizations. This paper presents a comprehensive methodology for organizational security decision-making processes and security system design. It builds on the house of quality (HOQ) (a customer-requirements planning matrix) by developing a house of security (HOS) that can translate the likelihood and severity of attack scenarios against organizations into a structure comprising security system components, ranked according to their likely effectiveness in preventing an attack. We assume that correlations between the system components might be changed for each scenario, i.e., several roofs, corresponding to the number of rows in the HOS matrix. For comparing different security systems designed to prevent the same threats, a measure of effectiveness is proposed. The analysis of variance method is utilized to select the vital security components by dividing the security components into two groups: vital few and trivial many.

Keywords: Decision making, quality functional deployment (QFD), security system

MATIX APPROACH TO ANALYSIS OF HUMAN ERROR AND THEIR PREVENTION BY QUALITY ENGINEERING AND MANAGERIAL TOOLS

Emil Bashkansky and **Shuki Dror**

We apply well-known quality engineering matrix techniques such as quality function deployment; Teoriya Resheniya Izobretatelskikh Zadatch (TRIZ); and failure mode, effects, and criticality analysis for characterizing, mapping, and preventing human error (or, at least, reducing damage caused by errors). Human errors ('WHATs', in the language of quality function deployment) are classified according to 10 characteristics, while 20 typical types (or protective layers)—'HOWs'—in quality assurance systems are proposed for preventing/stopping/minimizing, to some extent, damage caused by errors. During the analysis of a specific system, any error is estimated according to its likelihood and severity, and every protective layer receives a score according to its effectiveness in preventing errors. Synergy or antagonism between protective layers may also be taken into account when calculating the effectiveness. The approach facilitates evaluation and comparison of the effectiveness of different quality assurance systems dealing with human errors. The authors emphasize the need to create a 'recipe book' based on historical databases, which will enableapplication of the optimal prevention efforts, after characterizing the potential human errors according to the 10 criteria mentioned above.

Keywords: Human errors, prevention, quality engineering tools, QFD, TRIZ, FMECA

DETERMINANTS OF VALUE CREATION AND CUSTOMER VALUE IN THE IPS2 OPERATIONS PHASE

Reuven Karni and **Shuki Dror**

The advent of B2B industrial product-service systems (IPS2) requires a rethinking of business strategy on both the part of the provider and the customer. In particular, IPS2 depends on a close and collaborative relationship between them over an extended period of time. This relationship requires a certain distinctiveness of the B2B operations infrastructure; and affords the customer a distinctive set of value propositions intended to result in superior performance and business success. We present two sets of product service system (PSS) characteristics: (1) a set of value-creating activities and resources—value propositions, ownership, involvement in customer business, customer–provider communication and interaction, contracts and guarantees, information and knowledge channels, life cycle management, product life extension management, sustainability and regulation management, and customer value management—comprising the makeup of the IPS2; and (2) a set of value propositions—product (the tangible component of IPS2); service (the intangible component of IPS2); process (operational or customer usage or functional process); relationship (association between provider and customer); outcome (objective served through the IPS2 process operation); robustness and evolution of the IPS2 life cycle (continual creation of value throughout the IPS2 lifecycle); and costs (expenses incurred through IPS2 acquisition and implementation)—realizable by the customer.

Keywords: Industrial product-service systems (IPS2), operational phase, customer value, value creation activities and resources

TAGUCHI METHODS FOR OFF-LINE QUALITY CONTROL

Irad Ben-Gal and **Shuki Dror**

Three decades ago, Taguchi developed a systematic approach to off-line quality control and process design that is now known as the Taguchi method. Although some statistical aspects of the method are debatable, there is no argument that it has been widely applied to various processes and industries and has gained enormous attention. In this study, we summarize the main concepts of the Taguchi method and cover some of its implementations.

Keywords: Robust design, quality control, process optimization, parameter design, design of experiments, statistical experiments

A CORPORATE SOCIAL RESPONSIBILITY (CSR) MODEL – A QUALITY FUNCTION DEPLOYMENT BASED METHODOLOGY

Natalia Zaitsev and **Shuki Dror**

Corporate Social Responsibility (CSR) aims is to increase long-term profits through positive public relations, establish high ethical standards to reduce business and legal risks, and boost shareholder trust by taking responsibility for corporate actions. CSR strategies encourage the

company to make a positive impact on the environment and stakeholders including consumers, employees, investors, communities, and others.

The goals of an organization is a sustainable context called CSR Outcomes. According to discussions in the literature, the main outcomes of CSR are: Reputation, Consumer Loyalty & Positive Firm Evaluation, Stakeholder Relations, Customer Choice of Company/Product, Financial Performance, Firm Capability, Reduced Risk, and Enhanced Organizational Identification.

The present study seeks to create a framework that will investigate the relationship between all types ofindicators of an organization's activities, and the CSR outcomes, at the institutional level of CSR analysis. A structured methodological approach based on a quality function deployment (QFD) is developed.

Keywords: Corporate social responsibility (CSR), quality function deployment (QFD), outcomes CSR

A NEW FRAMEWORK FOR ORGANIZATIONAL KNOWLEDGE THAT ENABLES CRITICAL JUSTIFICATION

Doron Faran

Knowledge is defined as "justified true belief", but knowledge management pays very little attention to both justification and truth. This paper reviews the justification methods that organizations employ de facto— positivism, conventionalism and pragmatism—and discusses their weaknesses. The method of critical rationalism (CR) is then presented as a remedy for these weaknesses, and the opposition to this method in the organizational field is discussed. A new knowledge framework that realigns the canonical theories of organizational knowledge is constructed. The main argument in this paper is that the framework does facilitate CR. The implementation of CR is demonstrated in a case study.

Keywords: Knowledge, truth, justification, critical rationalism

ADVERTISING EFFECTIVENESS FROM THE HERMENEUTIC STANDPOINT

Doron Faran and **Arie Maharshak**

The core of our research focuses on the dilemma of advertising effectiveness. On the one hand, companies tend to invest substantial amounts of money in promoting their products, while on the other hand, quite often customers fail to understand the message embedded in a marketing campaign. Consequently, highly valued campaigns that received prestigious awards do not deliver. While the failures of advertising campaigns have been thoroughly investigated in the literature, few explanations for the failures have been proposed. Our contribution builds on the criticism of cognitive narrowness and takes the cultural stance a step further through application of the hermeneutic tradition.

Keywords: Advertisement, hermeneutics, interpretation, culture

APPLIED PROBABILITY

Tamar Gadrich, Haggai Katriel and **Rachel Ravid**

Applied probability is concerned with the application of probability theory to other scientific and engineering areas (e.g., physics, biology, medicine, computer science, technology and social sciences).

We apply generalizations of classical models to solve problems that have emerged in modern industry. Occupancy models are an example of one of the models used to generalize the classical coupon collector problem and applied in the area of statistical quality control.

Discrete-time population models are widely used in the field of population ecology. The population-level consequences of assumptions regarding the behavior of individual organisms is investigated using site-based models (bottom-up approach). We applied stochastic processes (discrete time Markov chain and Gaussian Markov chain approximation) and agent-based simulation approaches to investigate the system dynamics.

Keywords: Probability models, statistical quality control, occupancy problems, enumerative combinatorics, mathematical biology, ecology, population-dynamics, site-based models

CROSS CULTURAL HUMAN RESOURCE (HR) MANAGEMENT

Hilla Peretz and **Yitzhak Fried** (Texas Tech University, USA)

Cross cultural management focuses on content pertaining to HR management with a cross-border dimension. This longitudinal research study examines the effects of national values on a variety of HR practices (among them, performance appraisal, training strategies and HR information systems) as well as the effect of fit between HR practices and national values on organizational performance indicators. The study comprises a large sample of over 20 countries and is based on data from several years, with the goal of exploring the stability of these relationships before and after the financial crisis.

Keywords: National values, human resource management, organizational performance

ENVIRONMENTAL ECONOMICS

Natalia Zaitsev and **Mira Baron** (Technion—Israel Institute of Technology)

In the mid-1990s, we forecast the number of Israeli visitors to a unique planned recreational site in the north of Israel, currently known as Agmon Hula. The contingent valuation method used to predict this number was based on willingness to visit the planned site among tourists visiting all recreational sites in the region.

In the current study, we examine the assumptions and results of that study and compare the forecast to the actual outcome. We concentrate on the number of visitors forecast, which enables us to examine the economic impact and is crucial in analyzing the ecological carrying capacity.

The commodity planned was a site offering a safari, a bird sanctuary, horseback riding, a

swimming pool and a picnic area. The project, however, was not carried out as planned, and currently is a bird sanctuary only.
Our forecast of 380,000 visitors in the first year of operation did not materialize. Our prediction might have been closer to the actual number (220,000) if we had considered the percentage of respondents who ranked visitng bird sanctuaries as one of their two favorite activities.
We show that updating the predicted number of visitors is straightforward and plays a crucial role in predicting carrying capacity. A new forecast of the number of visitors over the next twenty years is made.

Keywords: Recreational site, forecasting the number of visitors, contingent valuation method

FLEXIBLE MANUFACTURING SYSTEMS (FMS): OPERATIONS AND CONTROL

Boris Shnits

Flexibility in FMS is made possible largely owing to the use of versatile and/or redundant machines, which in turn facilitate alternative system routing. Alternative routing enhances a system's ability to better balance machine workloads and achieve higher system robustness and productivity. To fully exploit these features, an FMS must be able to adapt to different shop conditions, i.e., for a given system status to select the appropriate operational policy in real-time. This research focuses on developing methodologies and control schemes that enable an FMS to improve its efficiency and productivity and to cope with the volatile production environment in which the FMS operates. These control schemes deal with solving a multi-criterion dynamic scheduling problem using optimization-based techniques and simulation.

Keywords: FMS control, dynamic scheduling, multi-criteria decision making, simulation

FLEXIBLE WORK ARRANGEMENTS: A CROSS-CULTURALPRESPECTIVE

Hila Peretz and **Yitzhak Fried** (Texas Tech University, USA)

Flexible work arrangements (FWAs) have become increasingly prevalent in the global competitive environment. We know. however, little about how societal cultures affect the implementation of FWAs and their effects on organizational outcomes. This research addressed this issue by focusing on two complementary topics: (a) the influence of five important societal (national) cultural values (power distance, uncertainty avoidance, individualism/collectivism, assertiveness, and future orientation) and key organizational variables and (b) the contribution of the level of congruence between these societal cultural values and FWAs on the organizational outcomes of absenteeism and turnover.

Keywords: Flexible work arrangements, national culture, organizational outcomes

GENERETATION Y: A CROSS-CULTURAL PERSPECTIVE

Hila Peretz and **Emma Parry** (Cranfield University, UK)

Increased life expectancies and initiatives to retain older workers for longer means that the workforce is becoming more age-diverse. Hence, employers need to develop a clear understanding of the work values, preferences and attitudes of the new generation entering the workforce (generation Y) and how they might differ from previous generations in order to effectively attract and manage this new cohort of employees. To date, research and practical advice has largely ignored the impact of national or cultural context on this diversity. This lacuna may explain the failure of so many studies to find generational differences in work values if the samples used were not from a single nationality. Specifically, the main question of this study is: Are generational differences (in work values and work behaviors) different among different cultures or are they global? In order to empirically examine the study question, a novel strategy will be used – data mining of social networks and turnover.

Keywords: Generations, work values, national culture

HUMAN FACTORS IN DESIGNING JOINT COGNITIVE SYSTEMS FOR MANUFACTURING

Nirit Gavish and **Hussein Naseraldin**

Recently, several cognitive systems for manufacturing management have been developed. In these systems, human and artificial intelligent entities work together as a team, a situation termed a "Joint Cognitive System." Humans utilize the computerized system most effectively if they accept the system's analysis of the problem and recommendations for handling it. Our assumption is that in joint cognitive systems for manufacturing, human performers begin their interaction and decision making processes using an explicit, analytic and theory-based style. After gaining experience with the results of their decisions, they shift to an implicit, experience-based non-analytic style. Hence, to achieve good cognitive coupling, the computerized system should adapt itself to performers' shifts in cognitive style. In other words, the system input should be analytic and theory-based at the beginning (e.g., "According to model X, the recommended production plan is Y") and later heuristic and experience-based (e.g., "Last time, in a similar situation, you chose production plan Y"). Our research hypothesis regarding the contribution of an adaptive cognitive style to the performance of the joint cognitive system will be empirically evaluated within a manufacturing management setting using simulation. The research will be conducted in two phases. The first phase will examine the hypothesis regarding the changes in the operator's cognitive style. In the second phase, the effect of the system's cognitive style will be evaluated using different cognitive styles in various stages and levels of interaction. Participants will be freshmen students in the Department of Industrial Engineering and Management at ORT Braude College of Engineering, Israel, who are enrolled in the course Introduction to Industrial Engineering.

Keywords: Joint cognitive systems, manufacturing, decision making, cognitive style

HUMAN RESOURCE AUTONOMY WITHIN MULTINATIONAL COMPANIES

Hilla Peretz and **Mila Lazarova** (Simon Fraser University, Vancouver, Canada)

Growing organizational dependence on international operations has highlighted the role of human resource management and has confronted organizations with the dilemma of having to find the right balance between global integration and local responsiveness. This research examines whether and under what circumstances subsidiary human resource autonomy enhances performance indicators. We seek to answer two major research questions: (1) Is a higher level of subsidiary human resource autonomy associated with improved subsidiary performance?, and (2) Is the relationship between level of subsidiary human resource autonomy and subsidiary performance influenced by cultural and institutional distance between the multinational companies headquarters and the subsidiary?

Keywords: Multinational companies, human resource, performance

HUMAN RESOURCE MANAGEMENT – DIVERSITY STUDY

Hilla Peretz

The realization of the importance of group diversity has been growing rapidly among organizations and research theorists. Diversity has been credited with both positive and negative outcomes for team performance. In our ongoing research we explore two major topics: (1) The factors influencing positive implementation of diversity with regard to group performance and its effectiveness and (2) The acceptance of affirmative action in different contextual settings (both organizational and national) and its implementation on performance.

Keywords: Diversity, team performance

INVENTORY MANAGEMENT

Illana Bendavid, Hussein Naseraldin and **Yale T. Herer** (Technion—Israel Institute of Technology)

A major decision in the supply chain context is the inventory level of a product along the supply chain. The inventory level affects the service level the customer receives and thus affects operational performance. Though decisions regarding inventory levels are typically made after several other strategic and tactical decisions are made, integrating inventory decisions with strategic decisions at an early stage has a crucial effect on overall performance. Inventory management encompasses inventory policies and practices. For example, lateral transshipment is a practice in which excess inventory is moved along the supply chain to locations with a shortage of inventory, thus eliminating excess and shortage costs.

Keywords: Inventory policy, inventory-location model, lateral transshipments, unit-price discount

LINE BALANCING

Boris Shnits

Production or assembly line balancing refers to assigning work elements and resources to workstations on the line so that the workload at all workstations is equal. One specific research direction involves the balancing of a robotic assembly line. In robotic assembly line balancing (RALB), the problem is that different robots may be assigned to assembly tasks, and each robot, because of its capabilities and specialization, needs different assembly times to perform a given task. The solution to the RALB problem includes finding the optimal assignment of robots to line stations and achieving a balanced distribution of work among the different stations. A genetic algorithm was used to find a solution to this problem.

Keywords: Line balancing, robotic assembly lines, genetic algorithms

MULTINATIONAL CORPORATIONS (MNCs)

Hilla Peretz

A multinational corporation (MNC) is defined as a corporation that has its managerial headquarters in one country and operates (manages production or delivers services) in several other countries. The purpose of this research is to build a model of a successful MNC based on three groups of factors: professional characteristics, organizational characteristics and similarities among countries. The aim of the study is to understand the necessary conditions for an MNC to attain high performance levels and thus to suggest a useful typology for MNCs.

Keywords: Multinational firms, organizational culture, professional culture, national culture

ORGANIZATIONAL AFFIRMATIVE ACTION PROGRAMS

Hilla Peretz and **Yitzhak Fried** (Texas Tech University, USA)

Organizational affirmative action programs (AAPs) have been widely adopted in the US, and have been extensively investigated as a major human resource activity. Over the past four decades, organizations have implemented AAPs to remedy discrimination against ethnic and racial minorities, women, and disabled people, and to diversify their workforces. Interestingly, AAPs have been implemented not only in the US, but also in organizations in other countries and cultures. Despite the increased globalization in the business environment, however, there is a paucity of research on the prevalence of AAPs across nations, and on whether societal values affect the type of AAPs that organizations implement.

Keywords: Affirmative action programs, national culture, absenteeism, turnover

PROJECT MANAGEMENT AND SCHEDULING

Illana Bendavid and **Boaz Golany** (Technion—Israel Institute of Technology)

Project scheduling is one of the nine knowledge areas in the body of knowledge comprising project management. This area is the keystone of project planning and control since it requires and integrates information about several project characteristics, such as estimated durations of activities, precedence constraints deriving from the technological precedence relations among the activities, resource constraints and due-date constraints. After this information has been processed, the scheduling activity generates a feasible schedule that optimizes one of the multiple existing objective functions, such as minimization of project duration, maximization of a project's net present value and many others. This feasible schedule is generally used as a baseline schedule according to which commitments with external entities are made for planning activities such as material procurement and delivery of orders. In other words, this schedule determines when suppliers have to deliver materials needed for the project activities and also sets due dates for subcontractors who execute some project tasks.

Keywords: Stochastic project scheduling problem, activity gate, flexible commitment, resource management, project control

QUALITY, DEPENDABILITY, HEALTHCARE AND SAFETY ENGINEERING

Emil Bashkansky, Tamar Gadrich, Shuki Dror, Rachel Ravid and **Yariv Marmor** in cooperation with the Department of Applied Mathematics

This research focuses on effective methods for evaluation, analysis, statistical control, prediction and improvement of quality measured using categorical scales. Such scales are also widely used in other fields of quality and safety engineering: customer satisfaction surveys, FMECA and risk analysis, defects and quality classification, inter- and intra-laboratory comparisons, homogeneity/heterogeneity tests, statistical process control, human errors classification and prevention, testing, diagnostics, healthcare analysis, QFD and others. In turn, design and analysis of optimal control schemes for such scales facilitates effective quality data mining and determination of dominant distinguishing parameters. Some of the developed methods are ready for immediate industrial application and have been applied for decision making in patient-involved health care, product quality classification and control, security arrangements and metrology.

Keywords: Quality control, categorical data analysis, prediction, improvement, human errors prevention, metrology, testing, diagnostics, QFD, categorical data

QUEUEING SYSTEMS

Rachel Ravid and **David Perry** (University of Haifa)

This research focuses on performance analysis of priority queuing systems. We assume that the systems are in a steady state, and our aim is to find the steady state probabilities and the customer sojourn time distribution.

Keywords: Queuing systems, renewal processes, priority queues

RISK MANAGEMENT

Meir Tahan, Tsvi Kuflik (University of Haifa) and **Efrat Yuval** (University of Haifa)

Development and deployment programs continue to suffer from budget overruns, schedule delays and poor technical performance, in most cases as a result of failure in handling uncertainty in complex software system development. Development communities lack a systematic method for identifying, communicating and resolving technical uncertainty. We focus on the risk identification stage and try to understand the reasons for unidentified risk appearing during project development. We interviewed project managers working in industry. The findings suggest that the unidentified risk factors can be divided into three main types: managerial, behavioural and external. Each category consists of factors, which through the awareness and openness of project teams and managers can help avert many problems and achieve project success.

Keywords: Risk identification, unidentified risks, uncertainty

ROBUST FACILITY LOCATION AND CAPACITY PLANNING

Hussein Naseraldin and **Opher Baron** (University of Toronto)

A facility refers to a retail outlet, service depot or production plant. In all cases, facility planning involves determining how many facilities to open so as to cover a demand created in a specific area. It also involves determining the location of each facility. By determining these two decisions, we fix most of the supply chain network structure. Several approaches to making these decisions are possible. Among others, a robust optimization approach guarantees solutions that are robust to changes in the parameters due to uncertainty, in particular uncertainty in demand.

Keywords: Number of facilities, network design, distance metric, robust optimization

ROBUST SCHEDULING

Hussein Naseraldin and **Boris Shnits**

Scheduling in service is an important operation. If uncertainty exists, robust optimization is a valid approach to adopt. While uncertainty can stem from various sources, the processing

time is a major factor. We focus on modeling and solving a scheduling problem in a hardware department that receives several requirements for board developments. Two types of resources are at hand: Designer and Layout. Several tasks are perfomed by each resource. The problem is to minimize the total tardiness of all boards. A major challenge in such an environment is the fact that the due date of the jobs, i.e., the boards, are on the critical path of the larger system development. Thus, improvement in the performance of the board development will have an impact on the system's performance.

ROBUST SCHEDULING

Hussein Naseraldin, Liron Yedidsion (Technion—Israel Institute of Technology) and **Chen Bukay** (Technion—Israel Institute of Technology)

Scheduling is a crucial aspect of operations control, be it in manufacturing or in service. There are various types of scheduling problems that the decision maker faces. Among others, there is the Due Date Assignment (DDA) problem, in which the objective is to minimize the costs by examining the resulting delivery time of each scheduled job. Among other reasons for delays in delivery time one can think of are: a machine can break; a machine is being setup; the operator is newly hired and is exploring his learning curve. The problem is exacerbated if the uncertainty is related to other types of data, for which we have no previous experience or historical data set. To cope with this limitation, robust optimization (RO) has been emerging as a promising methodology to incorporate uncertainty in the decision-making process, when not relying on full probabilistic information. In this research proposal, we utilize robust optimization in our modeling of scheduling problems with the purpose of deriving efficient solutions for these scheduling problems.

Keywords: Robust optimization, scheduling, due-date assignment

SERVICE DESIGN WITH APPLICATION TO EMERGENCY DEPARTMENT SYSTEMS

Tamar Gadrich, Shuki Dror and **Yariv Marmor**

To handle problems and trends in emergency department (ED) operations, designers and decision makers simulate and evaluate various scenarios before testing them in a real-life environment. Conceptualizing broad possible scenarios for ED operations prior to simulation, however, is usually neglected. We suggest a framework for the schematic conceptual development of these scenarios. We illustrate the application of our methodology in a specific ED. We contribute to the area of ED computer simulation by suggesting a methodology that offers the following advantages: (1) Simulation scenarios that can be schematically formulated rather than based on trial-and-error experiments; and (2) Scenario development that can be integrated in the different stages of simulation model development to support designers and management in understanding ED problems, improvement goals, the data that should be collected and the operational changes that should be applied.

Keywords: Simulation, design of experiments, conceptual modeling, scenarios, emergency department

SMART GRID OPERATIONS MANAGEMENT

Hussein Naseraldin and **Liron Yedidsion** (Technion—Israel Institute of Technology)

Technology development has led to a new electricity network type, czlled the Smart Grid. The basic notion behind the Smart Grid concept is to improve the overall efficiency of electricity production, delivery, and consumption, while increasing the reliability and security of the electrical grid. Deviations in electricity consumption rates throughout the day lead to different electricity pricing schemes. We assume that consumers (individuals and businesses alike) will adapt to the new pricing schemes and thus postpone usage of some electrical devices until off-peak periods (a plausible assumption). As a result, costs will be reduced. Furthermore, the electricity provider will benefit, as the demand at peak periods will be leveled and capacity requirements will be balanced over time. Smart Grid operation management involves the determination of related decisions using operation management and operations research tools and methodologies.

Keywords: Smart grid, lot-sizing, algorithm complexity

SUPPLY CHAIN DESIGN AND MANAGEMENT

Hussein Naseraldin

The main objective of supply chain management is to achieve operational excellence across all aspects of a firm. This can be achieved by maximizing the value created by each and every decision and operation. This optimization results in superior performance that leads to an increasing market share with satisfied customers. To achieve the above, all decisions must be aligned and integrated. That is, operational decisions must be taken into consideration when making strategic decisions. Among the most important strategic decisions in a supply chain context are the number and location of facilities.

Keywords: Supply chain design, network configuration, multi-echelon, supply chain performance

SYSTEM INTEGRATION

Meir Tahan

Engineering system integration presents a multiplicity of challenges. Among other things, different disciplines must be balanced, the work of several teams must be coordinated, and the issue of units that are necessary but not available on time must be handled. Special test equipment must be designed, hubs and stubs must be prepared, and risks that are liable to occur during integration must be assessed and prevented. All these problems and difficulties result in schedule delays and unplanned expenses.

We present a structured methodology for building an integration preparation plan and thereafter guiding the actual integration. The methodology is based on the "V" model for systems

engineering. The left side of the "V" represents the design stage and the right side represents the integration stage. The "looking forward" methodology follows the development steps, and at each step, looks forward to the relevant integration step, anticipating what may be required for successful integration. This action creates versatile integration tools that are sufficiently flexible to absorb unexpected variations in the project.

Keywords: System integration, testing, verification, validation

SYSTEM INTEGRATION

Meir Tahan and **Roy Benish** (HTS – High-Tech Solutions)

An integration plan is usually prepared intuitively by experienced engineers based on their previous experience and on project constraints. Since this plan is intuitive, it may be not optimal. The integration process involves severe uncertainties, such as units not being available on time, integration increment duration, and testing costs. Many times, such uncertainties cause changes in the project plan. The integration team members may find themselves unprepared for these changes—again, because the integration plan is not optimal. Our research offers a model-based software tool for finding an optimal path for system integration. The tool finds the optimum path assuming deterministic integration parameters or parameters with inherent uncertainties. The tool is designed for project managers, integration teams and academic integration research. It has built-in flexibility in order to serve a variety of organizations and users.

Keywords: System integration, integration plan, integration tool

THE EFFECT OF FEEDBACK ON IMPROVING VISUAL ATTENTION SKILLS

Nirit Gavish and **Hagit Krisher** (ORT Braude College – Students' Support Center)

A common cause of reading disorders is visual attention deficit. Research has demonstrated that training using a dedicated training program and protocol can improve visual attention skills and reading abilities. The common method is based on exposing trainees to slow smooth pursuit tracking of fragmented stimuli. This gradual exposure enables the trainees to acquire the needed visual attention skill. Until now, however, training was based solely on bottom-up processes, and higher-level cognitive inferences; top-down processes were not considered. The current research examines whether adding controlled feedback to the training protocol can support top-down processes which, in combination with bottom-up processes, will facilitate learning and skill transfer.

Keywords: Training, visual attention, reading, bottom-up, top-down

USE OF SERIOUS GAMING TO IMPROVE INTELLIGENCE ANALYSIS

Doron Faran and **Nirit Gavish**

The quality of intelligence analyses depends on the analysts' skills. Even though training programs supported by e-learning have shown progress, the creative reasoning skills and reflexes of law enforcement agents are not been completely optimized. This research focuses on understanding how analysts use both deduction and induction in their thinking, seeking ways to help them fully exploit their skills, knowledge, experience and creativity. Aa computerized training program that addresses the major training needs of analysts will be developed, and the serious gaming approach will be used for this training program.

Keywords: Intelligence, serious gaming, training, analysis

WATER QUALITY FUNCTION DEPLOYMENT

Natalia Zaitsev and **Shuki Dror**

Access to a reliable source of potable water is essential for the survival of human life and almost all living organisms. Technological advancements in the last decades have generated a variety of interchangeable methods for improving water quality. The present study seeks to create a framework that will facilitate the selection of the right technology by a water supplier aiming to improve the quality of tap water being supplied. A structured methodological approach based on a quality function deployment (QFD) is presented. This process extracts the desired improvements in water quality (as identified by its users through a questionnaire) and translates them into the required technical improvements, and ultimately, into core technologies ranked by importance. In constructing the water QFD, two matrices representing questionnaire results were analyzed. Normalized improvement scores were calculated at each of three hierarchical levels: customer requirements, technical parameters, and technologies. The components to be improved at each level were selected using analysis-of- variance (ANOVA). The methodology for selecting relevant technologies for improving tap water quality was implemented in the Galilee region in Israel.

Keywords: Quality function deployment, tap water quality, importance of technology

OPTIMAL CONTROL OF A TWO-SERVER FLOW-SHOP NETWORK

Yossef Luzon (Tel Aviv University)**, Yariv Marmor** and **Eugene Khmelnitsky** (Tel Aviv University)

We suggest a new, intuitive, and simple method for scheduling jobs in a two-server flow-shop network (FSN) with a minimum makespan objective. Multiple types of jobs with corresponding constant service times arrive at the network at various times over a finite time interval. An analog fluid network is proposed and its optimal fluid control policy determined. We make use of this optimal control policy to suggest a new method for scheduling jobs in the original discrete FSN and prove its asymptotic optimality. The method is particularly attractive because it falls into

the class of easy-to-implement and computationally inexpensive on-line algorithms. Numerical simulations are used to evaluate the performance of the suggested method and show that it performs optimally in almost all simulated instances. Some additional properties of the network are discussed and illustrated.

Keywords: Flow-shop network, scheduling policy, tandem fluid network, optimal control, fluid-based queueing discipline

OPTIMIZATION AND SIMULATION OF ORTHOPEDIC SPINE SURGERY CASES AT MAYO CLINIC

Asli Ozen (University of Massachusetts Amherst)**, Yariv Marmor, Thomas Rohleder** (Mayo Clinic)**, Hari Balasubramanian** (University of Massachusetts Amherst)**, Jeanne Huddleston** (Mayo Clinic) and **Paul Huddleston** (Mayo Clinic)

Spine surgeries tend to be lengthy (mean time of 4 hours) and highly variable (with some surgeries lasting 18 hours or more). This variability along with patient preferences motivating scheduling decisions has resulted in both low operating room (OR) utilization and significant overtime for surgical teams at Mayo Clinic. In this paper, we discuss the development of an improved scheduling approach for spine surgeries over a rolling planning horizon. First, data mining and statistical analysis were performed using a large data set to identify categories of surgeries that could be grouped together based on surgical time distributions and could be categorized at the time of case scheduling. These surgical categories are then used in a hierarchical optimization approach with the objective of maximizing a weighted combination of OR utilization and net profit. The optimization model is explored to consider trade-offs and relationships among utilization levels, financial performance, overtime allowance, and case mix. The new scheduling approach was implemented via a custom web-based application that allowed the surgeons and schedulers to identify the best surgical days interactively with patients. A pilot implementation resulted in a utilization increase of 19% and a reduction in overtime by 10%.

Keywords: Operating room scheduling, surgery scheduling, mixed-integer program

INPATIENT FLOW IN HOSPITALS: A DATA-BASED QUEUEING-SCIENCE PERSPECTIVE

Mor Armony (New York University)**, Shlomo Israelit** (Rambam Healthcare Campus)**, Avishai Mandelbaum** (Technion—Israel Institute of Technology)**, Yariv N. Marmor, Yulia Tseytlin** (IBM Research) and **Galit B. Yom-Tov** (Technion—Israel Institute of Technology)

Hospitals are complex systems with essential societal benefits and huge mounting costs. These costs are exacerbated by inefficiencies in hospital processes, which are often manifested by congestion and long delays in patient care. Thus, a queueing-network view of patient flow in hospitals is natural for studying and improving performance. The goal of our research is to explore patient flow data through the lens of a queueing scientist. The means is exploratory data analysis (EDA) in a large Israeli hospital, which reveals important features that are not readily

explainable by existing models. Questions raised by our EDA include: Can a simple (parsimonious) queueing model usefully capture the complex operational reality of the Emergency Department (ED)? What time scales and operational regimes are relevant for modeling patient length of stay in the Internal Wards (IWs)? How do protocols of patient transfer between the ED and the IWs influence patient delay, workload division and fairness? EDA also underscores the importance of an integrative view of hospital units by, for example, relating ED bottlenecks to IW physician protocols. The significance of such questions and our related findings raise the need for novel queueing models and theory, which we present here as research opportunities. Hospital data, and specifically patient flow data at the level of the individual patient, is increasingly collected but is typically confidential and/or proprietary. We have been fortunate to partner with a hospital that gave all the research partners access to its data. This enables reproducibility of our findings, through a user-friendly platform that is accessible via the Technion's SEELab.

Keywords: Hospitals operation, queueing netwrok, exploratory data analysis EDA, emergency department, internal ward

IMPROVING PATIENT ACCESS IN NUCLEAR MEDICINE: A CASE STUDY OF PET SCANNER SCHEDULING

Yariv N. Marmor, Bradley J. Kemp (Mayo Clinic)**, Todd R. Huschka** (Mayo Clinic)**, Royce L. Ruter** (Mayo Clinic)**, Daniel M. McConnell** (Mayo Clinic) and **Thomas R. Rohleder** (Mayo Clinic)

We used the systems engineering technique of discrete event simulation modeling to assist in increasing patient access to positron emission tomographic examinations in the Department of Nuclear Medicine at Mayo Clinic, Rochester. The model was used to determine the best universal slot length to address the specific access challenges of a destination medical center such as Mayo Clinic. On the basis of the modeling, a new schedule was implemented in April 2012 and our before- and after-data analysis shows an increase of 2.4 scans per day. This was achieved without requiring additional resources or negatively affecting patient waiting, staff satisfaction (as evaluated by day length), or examination quality.

Keywords: PET scan, simulation, appointment scheduling

APPOINTMENT SCHEDULING IN HEALTHCARE SYSTEMS

Illana Bendavid, Yariv N. Marmor and **Boris Shnits**

A critical step in the patient care path is diagnosis. The demand for advanced imaging tests such as CT, MRI and PET scans has increased dramatically in the past 15 years. Since imaging equipment remains relatively expensive, in order to meet the demand, imaging resources must be managed effectively while ensuring required service levels. In Positron Emission Tomography (PET), a radiopharmaceutical (radioactive substance) is injected into patients prior to their scans. The time between substance injection and scan (standby or uptake time) is rigid. This

constraint makes patient appointment scheduling more challenging, because if at the end of the expected uptake time, the scanner is not available, the quality of the scan is jeopardized (due to the short half-life duration of the substance). The availability of the scanner is a consequence of the preceding scans' appointments and durations. The aim of the current work is to develop an approach for appointment scheduling in a system with one or more scanners, given a sequence of patients and rigid uptake time, in order to minimize the end of day while satisfying a minimal pre-determined service level.

Keywords: Optimization, appointment scheduling, healthcare systems, service levels, simulation

Left: Prof. Emil Bashkansky (ORT Braude College of Engineering) – the Chairman of the VIII-th Galilee Quality conference. Right: Prof. Xavier Tort Martorell , the founder of the Centre for Quality and Productivity Improvement of Catalunya (Spain)
Annual Galilee Quality conference held at the ORT Braude College of Engineering 11.06.2015

CONFERENCES, WORKSHOPS & SEMINARS

THE ANNUAL GALILEE QUALITY CONFERENCE
Karmiel, Israel; June 2015, May 2014, May 2013
http://www.braude.ac.il/conferences/quality15/
http://www.braude.ac.il/conferences/quality14/
http://conferences.braude.ac.il/quality/quality13/

ISRAEL SUSTAINABLE DEVELOPMENT
ALTERNATIVE FUELS, WORKSHOP
Karmiel, Israel; January 2013
http://conferences.braude.ac.il/environmentalIndustry/2013/

The IE&M Department conducted 23 research-oriented seminars during 2013-2015.

REFEREED PAPERS

M. Armony, S. Israelit, A. Mandelbaum, Y.N. Marmor, Y. Tseytlin and **G. B. Yom-Tov**, Patient flow in hospitals: A data-based queueing-science perspective. *Stochastic Systems*, *5*(1), 146-194, 2015.

S. Dror and **D.A. Margol**, Framework for analyzing malpractice cases to improve healthcare systems. *Quality and Reliability Engineering International*. 31, 7: 1103–1113, 2015.

T. Gadrich, E. Bashkansky and **R. Zitikis**, Assessing variation: a unifying approach for all scales of measurement. *Quality and Quantity*, *49*(3), 1145-1167, 2015.

V. Glizer, V. Turetsky and **E. Bashkansky**, Statistical process control optimization with variable sampling interval and nonlinear expected loss. *Journal of Industrial and Management Optimization*, *11*, 105-133, 2015.

Y. Luzon, Y. Marmor and **E. Khmelnitsky**, Optimal control of a two-server flow-shop network. *Journal of Scheduling*, *18*(5), 513-524, 2015.

Y. Mikhaylidi, **H. Naseraldin** and **L. Yedidsion,** Operations scheduling under electricity timevarying prices. *International Journal of Production Research*, 53 (23), 7136-7157, 2015.

A. Ozen, Y.M. Marmor, T. Rohleder, H. Balasubramanian, J. Huddleston and **P. Huddleston**, Optimization and simulation of orthopedic spine surgery cases at Mayo Clinic. *Manufacturing & Service Operations Management*, *18*(1), 157-175, 2015.

H. Peretz, A. Levy and **Y. Fried**, Organizational diversity programs across cultures: Effects on absenteeism, turnover, and performance. *International Journal of Human Resource Management*, *26*(6), 875-903, 2015.

Y. Shaposhnik, Y. T. Herer and **H. Naseraldin**, Optimal ordering for a probabilistic one-time discount. *European Journal of Operational Research*, *244*, 803-814, 2015.

N. Yuviler-Gavish, T. Gutierrez, S. Webel, J. Rodriguez, M. Peveri, U. Bockholt and **F. Tecchia**, Evaluating virtual reality and augmented reality training for industrial maintenance and assembly tasks. *Interactive Learning Environments*, *23*, 778-798. 2015.

S. Dror, House of reliability costs: Developing reliability program activities. *Quality and Reliability Engineering International*,2014 ,375-380 ,(3)*30* .

M. Kaner, T. Gadrich, S. Dror and **Y. Marmor**, Generating and evaluating simulation acenarios to improve emergency department operations. *IIE Transactions on Healthcare Systems Engineering*, *4*(3), 156-166, 2014.

N. Yuviler-Gavish, J. Rodríguez, T. Gutiérrez, E. Sánchez and **S. Casado**, Improving the efficiency of virtual reality training by integrating partly observational learning. *Journal of Interactive Learning Research*, *25*, 487-587. 2014.

E. Bashkansky and **T. Gadrich**, Some statistical aspects of binary measuring systems. *Measurement*, *46*, 1922-1927, 2013.

S. Dror, E. Bashkansky and **R. Ravid**, House of security. *International Journal of Safety and Security Engineering*, *2*(4), 1-13, 2013.

T. Gadrich, E. Bashkansky and **I. Kuselman**, Comparison of biased and unbiased estimators of variances of qualitative and semi-quantitative results of testing. *Accreditation and Quality Assurance*, *18*(2), 85-90, 2013.

M. Kaner, T. Gadrich, S. Dror and **Y. Marmor**, Conceptualizing emergency department scenarios: A DSE-based methodology. *International Journal of Service Science, Management, Engineering and Technology, 4*(1), 30-48, 2013.

I. Kuselman, E. Kardash, M. Epstein, E. Bashkansky, K. Ginsbury, F. Pennecchi, A. Fajgelj, L. R. Stephen, S. Ellison and **Y. Karpov**, House-of-security approach to measurement in analytical chemistry: quantification of human error using expert judgments. *Accreditation and Quality Assurance*, *18*, 459-457, 2013.

Y. N. Marmor, B. J. Kemp, T. R. Huschka, R. L. Ruter, D. M, McConnell and **T. R. Rohleder,** Improving patient access in nuclear medicine: A case study of PET scanner Scheduling. *Quality Management in Healthcare*, *22*(4), 293-305, 2013.

S. Webel, U. Bockholt, T. Engelke, N. Gavish, M. Olbrich and **C. Preusche**, An augmented reality training platform for assembly and maintenance skills. *Robotics and Autonomous Systems*, *61*, 398-403. 2013.

N. Yuviler-Gavish, S. Krupenia and **D. Gopher**, Task analysis for developing maintenance and assembly virtual reality training simulators. *Ergonomics in Design*, *21*, 12-19. 2013.

N. Zaitsev and **S. Dror**, Water quality function deployment. *Quality Engineering*, *25*(4), 356-369, 2013.

ACCEPTED FOR PUBLICATION

E. Bashkansky and **S. Dror**, Matrix approach to analysis of human errors and their prevention by quality engineering and managerial tools. *Quality and Reliability Engineering International*.

I. Ben-Gal and **S. Dror**, Taguchi method for off-line quality control. *Wiley StatsRef: Statistics Reference*.

V. Turetsky and **E. Bashkansky**, Testing and evaluating one-dimensional latent ability. *Measurement*.

N. Yuviler-Gavish and **H. Krisher**, The effect of feedback during computerised system training for visual temporal integration. *International Journal of Learning Technology*.

N. Yuviler-Gavish and **H. Krisher**, The effect of computerized system feedback availability during executive function training. *Journal of Educational Computing Research*.

N. Yuviler-Gavish and **H. Naseraldin**, The effect of previous expereince when introducing a decision aid in a decision support system for supply chain management. *Cognition Technology and Work*.

BOOKS AND CHAPTERS IN BOOKS

N. Gavish and **H. Naseraldin**, The effect of timing when introducing a decision aid in a decision support system for supply chain management. In *Human Interface and the Management of Information. Information and Knowledge in Context*. Switzerland: Springer International Publishing, pp. 101-108, 2015.

Z. Rosenblatt, H. Peretz and **L. Kremer-Hayon**, Teacher participation in decision making in the Israeli school system. In: A. Menlo, T. Wubbles, L. Collet, J. Williamson and Z. Rosenblatt, *Teachers' involvement in change: A comparative view*. Rotterdam, The Netherlands: Sense, pp. 144-166, 2015.

N. Gavish, Applying the principles of human–computer interaction to improve the efficiency of the emergency medicine unit. In: D. Gopher & Y. Donchin (Eds.), *Around the patient bed: Human factors and safety in health care*. FL, USA: Taylor & Francis Group: CRC Press, pp. 119-130, 2013.

N. Gavish and M. Shelef, Evaluating two modes of observational learning in cognitive-spatial task training. In: D. Harris (Ed.), *EPCE/HCII 2013, Part I, Lecture notes in artificial intelligence 8019***,** Berlin Heidelberg: Springer-Verlag, pp. 222-231, 2013.

H. Peretz, Information technology systems in the HR area. In: E. Parry, E. Stavrou-Costea & M. Lazarova. (Eds), *Global trends in human resource management*, London, UK: Palgrave Macmillan, pp. 214-236, 2013.

REFEREED CONFERENCE PROCEEDINGS

S. Dror, QFD for design simulation experiments of service processes. *Proceedings of the RESER 2015 conference*, Copenhagen, Denmark, 10-12 September, 2015.

S. Dror and **E. Bashkansky**, House of Security (HOS) for Preventing Human Errors. *Proceedings of the European Network for Business and Industrial Statistics (ENBIS15) Conference*, Prague, Czech Republic, 6-10 September, 2015.

H. Naseraldin and **O. Baron**, Robust capacity planning under service constraints. *German-Austrian OR*, University of Vienna, Vienna, Austria, 1-4 September, 2015.

H. Peretz, and **P. Emma**, The impact of national culture on the use and outcomes of E-HRM. *Proceedings of the Academy of Business*, Paris, France, 20-22 May, 2015.

S. Dror, E. Bashkansky and **R. Ravid**. HOUSE OF SECURITY (HOS) – From attacks scenarios to security system components. *Proceedings of the RESER 2014 Conference*, Helsinki, Finland, 11-13 September, 2014.

S. Dror and **D. Margol**, A framework for analyzing malpractice cases to improve healthcare systems. *Proceedings of the European Network for Business and Industrial Statistics (ENBIS14) Conference*, Linz, Austria, 21-25 September, 20**1**4.

R. Karni, and **S. Dror**, Determinants of value creation and customer value in the IPS2. *Proceedings of the 20th ICE Conference – IEEE TMC Europe*, Bergamo, Italy, 13-15 June, 2014.

H. Peretz, A. Levi and **Y. Fried**, Dual effects of subsidiary and parent organizations' human resource practices on employee responses. *Proceedings of the Academy of Management*, Philadelphia, PA, USA, 8-12 August, **201**4.

T. P. Roh, T. R. Huschka, M. J., Brown and **Y. N. Marmor**, Data-driven simulation use to determine bed resource requirements for the redesign of pre-and post-operative care areas. *Proceedings of the 2014 Winter Simulation Conference*, pp. 1168-1176, 7 December, 2014.

N. Gavish and **H. Krisher**, The effect of knowledge of results during computerized system training. *Proceedings of the 5th International Conference on Applied Human Factors and Ergonomics*, pp. 140-147, Kraków, Poland, 2014.

H. Naseraldin and **O. Baron**, Robust cpacity planning under service constraints. *Institute for Operations Research and Management Sciences (INFORMS)*, San Francisco, California, USA, 2014.

T. Gadrich and **E. Bashkansky,** Correlation paradox of binary classification system., *Proceedings of the 59th World Statistics Congress*, pp. 3544-3549, Hong Kong, China, 25-30 August, 2013.

H. Peretz and **Y. Fried**, Human resource management practices and organizational innovation: The moderating role of national culture. *Proceedings of the Academy of Management*, Orlando, FL, USA, 9-13 August, 2013.

H. Peretz and **M. Lazarova**, The effectiveness of subsidiary HR autonomy within multinational companies: The moderating role of cultural and institutional distance. *Proceedings of the Academy*

of Management, Orlando, FL, USA, 9-13 August, 2013.

H. Naseraldin and **Y. T. Herer**, Impacts of practicing lateral transshipments on designing and operating a supply chain. *MS&OM*, INSEAD, France, 2013.

ORAL PRESENTATION AT INTERNATIONAL CONFERENCES

E. Bashkansky, *15th Annual European Network for Business and Industrial Statistics (ENBIS) Conference*, Prague, Czech Republic, 6-9 September, 2015.

E. Bashkansky, *21st World Congress IMEKO***,** 30 August-4 September, Prague, Czech Republic, 2015.

E. Bashkansky, *Joint Statistical Meetings*, 8-13 August, Seattle, WA, USA, 2015.

T. Gadrich and H. Katriel, Effect of reproductive distribution on the behavior of stochastic versions of population-dynamics models. *European Meeting of Statistians (EMS 2015)*, Amsterdam, The Netherlands, 6-10 July, 2015**.**

T. Gadrich and H. Katriel, From scramble competition to stochastic Ricker models. *16th Applied Stochastic Models and Data Analysis (ASMDA 2015)*, Piraeus, Greece, 30 June-4 July, 2015**.**

E. Bashkansky, *Advanced Mathematical and Computational Tools in Metrology and Testing (AMCTM 2014)*, St. Petersburg, Russia, 10-12 September, 2014.

E. Bashkansky, *Joint Statistical Meetings*, 2-8 August, Boston, MA, USA, 2014.

H. Peretz, Undertaking cross-cultural research using international networks. Presented at *Academy of Management*, Philadelphia, PA, USA, 8-12 August, 2014.

E. Bashkansky and T. Gadrich, Sorting machine correlation paradox. *Joint Statistical Meetings*, Montreal, QC, Canada, 2-8 August, 2013.

D. Faran, The theory-of-action and the explanatory theory in organizations: Distinction, explication and cross-coherence. *International Conference on Organizational Learning, Knowledge and Capabilities* (*OLKC2013*), Washington, DC, USA, 25-27 April, 2013.

T. Gadrich and E. Bashkansky, Correlation paradox of binary classification system. *59th conference World Statistical Congress of the International Statistical Institute* (ISI 2013), Hong Kong, China, 25-30 August, 2013**.**

R. Ravid, Further results in the LQ systems with exchangeable items. *EURO-INFORMS Joint International Meeting*, Rome, 2013.

R. Ravid, O.J Boxma and **D. Perry**, "Marginal Distribution of the Queues Lengths in the Longest Queue Systems", *The 26th EURO-INFORMS Conference*, Rome, Italy, July 1-4, 2013.

NON REFEREED CONFERENCE PROCEEDINGS AND ABSTRACTS

E. Bashkansky, *ISRANALYTICA – 18th Annual Meeting of the Israel Analytical Chemistry Society*, 14-15 January, 2015, Tel Aviv, Israel; invited round-table moderator, 2015.

E. Bashkansky, *Quality Management to Achieve Organizational Leadership*, 11 March, AFEKA Academic College, Israel; invited lecture at one-day symposium, 2015.

E. Bashkansky, *13th National Conference of the Israel Society for Quality*, 24-25 November, Tel Aviv; session chair, 2015.

I. Bendavid, Y. Marmor and **B. Shnits**, An appointment scheduling policy for healthcare systems with multiple servers, non-flexible uptake time, and pre-determined services levels. *11th ORT Braude College Interdisciplinary Research Conference*, p. 39, Kibbutz Hagoshrim, Israel, 2015.

I. Bendavid, Y. Marmor and **B. Shnits**, Developing an optimal appointment scheduling for systems with non-flexible standby time under pre-determined service levels. *The Operations Research Society of Israel* (ORSIS), Haifa, Israel, 2015.

I. Bendavid, Y. Marmor and **B. Shnits**, Developing an optimal appointment scheduling for systems with non-flexible standby time under pre-determined service levels. *19th Industrial Engineering and Management Conference (IE&M 2015)*, Tel Aviv, Israel, 2015.

D. Faran, N. Gavish and **M. Berman**, Training for exploration disposition in theory of mind. *Initiatives for Promoting Learning in Higher Education,* ORT Braude College, Karmiel, Israel, 2015.

D. Faran, N. Gavish and **M. Berman**, Training for exploration disposition in theory of mind. *11th ORT Braude College Interdisciplinary Research Conference*, Hagoshrim, Israel, 7-8 October, 2015.

T. Gadrich and **H. Katriel**, Statistical estimation of population parameters with multiple measurements. *11th ORT Braude College Interdisciplinary Research Conference*, Hagoshrim, Israel, 7-8 October, 2015.

N. Gavish and **H. Naseraldin**, The effect of timing and complexity of the decision aid in a decision support system for supply chain management. *11th ORT Braude College Interdisciplinary Research Conference,* Hagoshrim, Israel, 7-8 October, 2015.

N. Gavish, H. Krisher and **G. Madar**, The effect of feedback on puzzle completion task training. *19th Israeli Industrial Engineering & Management Conference (IE&M 2015)*, Tel Aviv, Israel, 2015.

N. Gavish, H. Krisher and **G. Madar**, The effect of feedback on puzzle completion task training. *2nd Conference on Cognition Research of the Israeli Society for Cognitive Psychology*, Acre, Israel, 2015.

N. Gavish and **H. Naseraldin**, The effect of previous experience when introducing a decision aid in a decision support system for supply chain management, *IsraHCI 2015*, Herzliya, Israel, 2015.

H. Naseraldin and **B. Shnits**, Robust adaptive job-shop scheduling. *11th ORT Braude College Interdisciplinary Research Conference*, p. 46, Hagoshrim, Israel, 2015.

R. Ravid, Two-sided geometric distribution via the Poisson process. *11th ORT Braude College Interdisciplinary Research Conference*, Hagoshrim, Israel, 7-8 October, 2015.

E. Bashkansky, *18th Industrial Engineering and Management Conference*, 25-26 March, Tel Aviv, 2014.

E. Bashkansky, *20th International Conference of the Israel Society for Quality*, November, Tel Aviv, 2014.

I. Bendavid, Y. Marmor and **B. Shnits**, Developing an optimal appointment scheduling for healthcare systems with non-flexible uptake time under pre-determined service levels. *10th ORT Braude College Interdisciplinary Research Conference*, p. 12, Nahariya, Israel, 19-20 October, 2014.

T. Gadrich and **E. Bashkansky,** Statistical characteristics of binary sorting machines. *Measurements and Standards in Quality Management: Developments and Trends*, The Open University of Israel, Raananna, Israel, 6 January, 2014**.**

T. Gadrich and **H. Katriel**, Stochastic versions of population-dynamics models via 'balls-bins' techniques. *10th ORT Braude College Interdisciplinary Research Conference*, Nahariya, Israel, 19-20 October, 2014.

N. Gavish, H. Krisher and **G. Madar**, The effect of feedback on puzzle completion task training. *10th ORT Braude College Interdisciplinary Research Conference,* Nahariya, Israel, 19-20 October, 2014.

N. Gavish and **H. Naseraldin**, The value and timing of introducing knowledge in decision support systems. *18th Israeli Industrial Engineering & Management Conference (IE&M 2014)*, Tel Aviv, Israel, 2014.

N. Gavish and **H. Krisher**, The effect of knowledge of results during computerized system training. *18th Israeli Industrial Engineering & Management Conference (IE&M 2014)*, Tel Aviv, Israel, 2014.

N. Gavish and **H. Krisher**, The effect of knowledge of results during computerized system training on temporal visual integration. *IsraHCI 2014*, Haifa, Israel, 2014.

N. Gavish and **H. Krisher**, The effect of knowledge of results during computerized system training on temporal visual integration. *1st Conference on Cognition Research of the Israeli Society for Cognitive Psychology*, Acre, Israel, 2014.

R. Ravid, Further results in the LQ systems with exchangeable items. *10th ORT Braude College Interdisciplinary Research Conference*, 2014.

R. Ravid, On the longest queue system with exchangeable items. *Orsis*, Tel Aviv University, 2014.

B. Shnits, Mathematic models for adaptive scheduling in FMS environment. *18th Industrial Engineering and Management Conference (IE&M 2014)*, Tel Aviv, Israel, 2014.

E. Bashkansky, *International Workshop on Human Errors and Out-of-Specification Test Results*, 29 January, Tel Aviv, Israel, 2013.

E. Bashkansky, *12th National Conference of the Israel Society for Quality*, 29-30 November, Tel Aviv, 2013.

N. Gavish and **H. Krisher**, The effect of knowledge of results during computerized system training on temporal visual integration. *6th Israeli Industrial Engineering & Management Research Conference*, Jerusalem, Israel, 2013.

N. Gavish and **H. Naseraldin**, The value and timing of introducing knowledge in decision support systems. *9th ORT Braude College Interdisciplinary Research Conference,* Hagoshrim, Israel, 2013.

N. Gavish, E. Yechiam, M. Shelef and **A. Kallai**, The effect of visual guidance in multi-modal training of spatial tasks. *IsraHCI 2013*, Herzliya, Israel, 2013.

R. Ravid, O.J. Boxma, D. Perry, Sojourn times in the longest queue system with exchangeable items. *6th Israel Industrial Engineering and Management Research Meeting (IIERM)*, Ma'aleh Hahamisha, Israel, 2013.

B. Shnits, Controlling FMS based on dynamically creating the local optimal schedules for dynamically selected appropriate operational criteria. *9th ORT Braude College Interdisciplinary Research Conference*, p. 24, Kibbutz Hagoshrim, Israel, 2013.

OTHER PUBLICATIONS

E. Bashkansky, ISO/TR 79:2015, Reference materials – Examples of reference materials for qualitative properties. First edition 2015-04-15, Ch.6 , see: https://www.iso.org/obp/ui/#iso:std:iso:tr:79:ed-1:v1:en

GRANTS

N. Gavish, *Ministry of Economy and Industry. Grant for Preventive Activities Research*, Principal Investigator, 2015-2017.

H. Peretz, *Generation Y and work values: A cross-cultural examination using data mining of social networks*, (*SHRM Foundation*), Principal Investigator. Joint grant with Y. Fried and E. Parry, 2015-2017.

H. Peretz, *Human resource management in multinational companies*, (*SHRM Foundation*), Principal Investigator. Joint grant with Y. Fried and S. Kaminka, 2010-2013.

JOURNAL REFEREE

E. Bashkansky
Quality and Reliability Engineering International
Applied Stochastic Models in Business and Industry

Journal of Testing and Evaluation
Measurement
Accreditation and Quality Assurance
Journal of Probability and Statistics
Computers & Industrial Engineering
Quality Engineering
Journal of Statistical Theory and Practice

I. Bendavid

Mathematics of Operations Research
Naval Research Logistics
OMEGA
MSO&M Conference

D. Faran

Management Learning

T. Gadrich

Probability and Statistics Letters
Quality Technology and Quantitative Management
Journal of Applied Statistics

N. Gavish

International Journal of Human-Computer Interaction
Interactive Learning Environment
International Journal of Advanced Robotic Systems
Journal of Computer Assisted Learning
Journal of Educational Computing Research
Cognition Technology & Work
PLOS ONE

H. Naseraldin

Manufacturing & Service Operations Management
Management science
IIE Transactions
Naval Research Logistics
Production and Operations Management
Journal of Operations Management
European Journal of Operational Research
Applied Mathematical Modeling

International Journal of Production Research
Computers and Industrial Engineering
Central European Journal of Operations Research

H. Peretz

European Journal of Work and Organizational Psychology
International Organizational Performance
Leadership Quarterly
Human Resource Management Journal

B. Shnits

International Journal of Production Research

Department of Mathemtics & Applied Mathematics

Prof. Lavi Karp, D.Sc.,
Head of the Department

RESEARCH AREAS

ALGEBRA

Mark N. Berman, Gabriel Ben Simon, Alexander Goldvard and **Shifra Reif**

The problem of classifying groups of a given class is hard. Even though the problem for finite simple groups has been solved, it remains open for many other interesting classes of groups (both finite and infinite). In the class of finitely generated torsion-free nilpotent groups, though classification is intractable, it is fruitful to study the growth of subgroups—that is, how the number of subgroups of a given index grows with the index. These numbers, encoded in a zeta function, have been studied using tools from a wide variety of disciplines, such as model theory, representation theory of algebraic groups, combinatorics and arithmetic geometry. Berman is studying this counting problem in special cases as part of a more general project to understand the relationship between the arithmetic of subgroup growth and the structure of the parent group.

Ben Simon deals with Lie groups and geometric group theory. Here we study groups, especially Lie groups and discrete groups, via imposing geometrical structures on the groups and studying it as a geometrical object. In this approach, both sides of the groups—the algebraic and the geometric one—are important. Strong relations to important fields in mathematics exist.

Keywords: Finitely generated nilpotent groups, algebraic groups, representation theory, combinatorics, zeta functions of groups, subgroup growth, p-adic integration

BIOMATHEMATICS

Ronen Avni (ORT Braude College and Technion—Israel Institute of Technology**), David Burg** (Ohalo Collage and Golan Research Institute)**, Amit Hupert** (Gertner Institute, Chaim Sheba Medical Center, Tel Hashomer)**, Haggai Katriel, Ezer Miller** (ORT Braude College and Gertner Institute)**, Jurii Kozicki** (University of Maria Curie-Sklodowska, Poland) and **Lewi Stone** (Tel Aviv University)

Mathematical models are an important tool in the effort to understand the behavior of complex systems. Mathematical biology involves the study of dynamical systems relevant to biological phenomena, at different levels: from the subcellular level (biochemical kinetics, gene regulation), through the level of the organism (physiological processes, inter-host dynamics of infections, cancer), up to the level of populations (ecology, epidemiology, population genetics and evolution). Important modeling approaches include ordinary and partial differential equations, discrete-time dynamical systems, stochastic processes, and agent-based simulation. We are interested in theoretical and mathematical investigation of dynamic models, in the formulation of new models, and in fitting mathematical models to experimental, clinical and epidemiological data, using modern statistical methods.

Keywords: Mathematical modeling, mathematical biology, ecology, epidemiology

COMPLEX DYNAMICAL SYSTEMS

Mark Elin, Marina Levenshtein, David Shoikhet, Fiana Yacobzon, Filippo Bracci (Universitá di Roma "Tor Vergata", Italy)**, Manuel D. Contreras** (Universidad de Sevilla)**, Santiago Díaz-Madrigal** (Universidad de Sevilla) and **Simeon Reich** (Technion—Israel Institute of Technology)

The development of complex dynamical systems has been the subject of research from the beginning of the 20th century. One of the first applicable models for complex dynamical systems arose from studies of stochastic branching processes in the growth of families and populations. Interest in these models has further increased because of their connections to chemical and nuclear chain reactions, the theory of cosmic radiation, and many other biological and physical problems.

The examination of these problems is based on one-parameter semigroups of holomorphic self-mappings of the unit disk of a complex plane, which is our sphere of interest. We study the asymptotic behavior of discrete and continuous time semigroups (in one-dimensional and multi-dimensional settings), rates of convergence of semigroups to their attractive fixed points, and boundary rigidity problems for semigroups and their generators. We are also interested in criteria of analytic extension of semigroups in their parameter.

Keywords: Semigroup, infinitesimal generator, iteration theory, asymptotic behavior, rigidity

CONTROL THEORY, DIFFERENTIAL GAMES AND OPTIMIZATION

Valery Y. Glizer, Alexander Goldvard, Vladimir Turetsky, Oleg Kelis, Gideon Avigad (Department of Mechanical Engineering), Emilia Fridman (Tel Aviv University)**, Leonid Fridman** (National Autonomous University of Mexico) and **Galina A. Kurina** (Voronezh State University, Russia)

Control theory examines ways to manipulate input to a dynamic system in order to obtain desired behavior and output. Differential game theory focuses on the optimal strategies of several agents subject to their differing and often opposing goals. Optimization theory studies methods for choosing an optimal element from a given admissible set.

Prof. Glizer's research focuses on control problems and differential games with singularly perturbed dynamics; cheap control problems; singular control problems; robust control problems; differential games with perfect and imperfect information; differential games with hybrid dynamics; singular differential games; multi-objective differential games; singularly perturbed ODE, PDE, functional-differential equations, difference equations; nonlinear stochastic differential and difference equations; nonlinear theory of generalized functions and its applications.

Dr. Goldvard focuses on the solution of multi-criteria (multi-objective) optimization problems via evolutionary algorithms.

Prof. Turetsky is engaged in studying pursuit-evasion games with perfect and imperfect information; robust control; generalized linear-quadratic games; optimal control; cheap control problems; differential games with hybrid dynamics; invariant sets for feedback strategies; inverse problems of signal restoration and differentiation.

Keywords: System analysis, control design, non-cooperative and antagonistic games, multi-objective optimization

GEOMETRIC FUNCTION THEORY

Mark Elin, Marina Levenshtein, David Shoikhet, Fiana Yacobzon, Dov Aharonov (Technion), **Lev Aizenberg** (Bar-Ilan University)**, Vladimir Bolotnikov** (College of William and Mary, USA)**, Nikolai Tarkhanov** (Universität Potsdam, Germany) and **Lawrence Zalcman** (Bar-Ilan University)

Geometric function theory focuses on the geometric properties of univalent mappings. This subject has been examined with changing emphasis for over a hundred years. Well-known results in this field include the Riemann mapping theorem, hyperbolic geometry, the Schwarz Lemma, the Julia-Wolff-Caratheodory Theorem and others.

Our research focuses on biholomorphic mappings on a unit ball (in one-dimensional and multi-dimensional complex spaces). We study the geometric structures of these mappings, including star-like and spiral-like mappings with respect to an interior point or a boundary point, convex functions in one direction and so on. Geometric characteristics of images involve distortion and covering theorems and boundary behavior of different classes of mappings, as well as interpolation problems.

Keywords: Star-like, spiral-like functions, distortion theorems, boundary behavior

MATHEMATICAL EDUCATION

Buma Abramovitz, Miryam Berezina, Ludmila Shvartzman, Fiana Yacobzon, Abraham Berman (Technion—Israel Institute of Technology) and **Boris Koichu** (Technion—Israel Institute of Technology)

The main purpose of this research is to develop methods for teaching mathematics at the undergraduate level in order to improve students' understanding.

MATHEMATICAL PHYSICS

Gabriel Ben Simon, Lavi Karp and **Shifra Reif**

Mathematical Physiscs: Using geometrical language and tools, we study Hamiltonian dynamical systems, which are one formal way to describe classical mechanical systems. The field of symplectic geometry, which emerged in the late 1980s, is the modern name for this research activity. Symplectic geometry, as a new approach to this classical object, has been found to be a very useful tool in string theory and Super Symmetry (Gromov-Witten Invariants are one example of applications taken from symplectic geometry and used in these physical theories).

Keywords: Mathematical education, understanding, undergraduate level

OPERATOR THEORY AND NONLINEAR ANALYSIS

Mark Elin, Haggai Katriel, Victor A. Khatskevich, David Shoikhet, Daniel Alpay (Ben-Gurion University)**, Tomas Azizov** (Voronezh State University, Voronezh, Russia)**, Lawrence Harris** (University of Kentucky, USA)**, Jurii Kozicki** (University of Maria Curie-Sklodowska, Poland)**, Tadeusz Kuczumov** (University of Maria Curie-Sklodowska, Poland)**, Simeon Reich** (Technion—Israel Institute of Technology)**, Victor Shulman (**Vologda State Technical University, Russia) and **Jaroslav Zemanek** (Polish Academy of Sciences, Warsaw, Poland)

This research focuses on fixed point theory and operator methods and their applications to holomorphic semigroups, dichotomy in spaces of operators, Abel and Schroeder type functional equations and others. We aim to give some parametric descriptions of bistrict plus operators and some groups of automorphisms of the unit operator ball. We are also interested in the structure of images of operator linear fractional relations. Further, we are studying different properties of the spectrum of single operators and families of operators as well composition operators that form a special but very important class of linear operators.

Keywords: Hilbert space, orthogonal systems of vectors, linear operator, spectrum of operator

PARTIAL DIFFERENTIAL EQUATIONS AND GENERAL RELATIVITY

Lavi Karp, Oleg Kelis, Yakov Lutsky, Victor Ostrovki, Uwe Brawer (Universidad Complutense de Madrid, Spain)**, Igor Gaissinski** (Technion), **Vladimir Rabinovich** (Instituto Politécnico Nacional, Mexico) and **Vladimir Rovenski** (University of Haifa)

The subject of general relativity has long been of interest in both mathematics and physics and is a rich source of problems in both global and nonlinear partial differential equations. Our main studies deal with Einstein-Euler systems that describe relativistic self-gravitating perfect fluids and modeling of isolated systems such as stars. The group also studies the following areas: Inverse problems at potential theory, free boundary problems, Hele-Shaw flows, pseudodifferential operators with applications to elliptic and parabolic partial differential equations, mathematical models for hydrodynamics.

Keywords: Einstein equations, nonlinear PDE, pseudodifferential operators, potential theory, free boundary problems

CONFERENCES, WORKSHOPS & SEMINARS

COMPLEX ANALYSIS & DYNAMICAL SYSTEMS VII

May 2015

International conference with over 100 participants from more than 50 academic and research institutes worldwide, Nahariya, Israel.

http://www.braude.ac.il/conferences/cads7/

WORKSHOP ON OPERATOR THEORY

February, 2014

The workshop on Operator Theory in honor of Professor Victor Khatskevich's retirement

http://www.braude.ac.il/conferences/workshop_on_operator_theory/

WORKSHOP ON COMPLEX AND HARMONIC ANALYSIS

June 2014

The workshop provided a forum for discussions and exchange of new ideas, concepts and recent developments in modern analysis.

It was organized as a satellite meeting of the Second Joint International Meeting of the Israel Mathematical Union and the American Mathematical Society.

http://www.hit.ac.il/acc/golberga/CHA14/CHA14.html

FORTHCOMING CONFERENCES

WORKSHOP ON MATHEMATICAL EDUCATION IN SCIENCE AND TECHNOLOGY

February, 2016

A workshop on Mathematical Education in honor of Doctor Miryam Berezina's retirement

http://www.braude.ac.il/conferences/the_workshop_on_mathematical_education_in_science_and_technology/

SECOND WORKSHOP ON COMPLEX AND HARMONIC ANALYSIS

April 2016

The workshop will provide a forum for discussions and exchange of new ideas, concepts and recent developments in modern analysis.

http://www.hit.ac.il/acc/golberga/CHA14/CHA14.html

REFEREED PAPERS

R. Adar and **L. Epstein,** The weighted 2-metric dimension of trees in the non-landmarks model. *Discrete Optimization*, 17, 123-135, 2015.

G. Ben Simon and **T. Hartnick**, Quasi-total orders and translations numbers. *Groups Geometry and Dynamics*, *9*, 479-530, 2015.

M. N. Berman and **B. Klopsch,** A nilpotent group without local functional equations for proisomorphic subgroups. *Journal of Group Theory*, *18*, 489-510, 2015.

F. Bracci, Y. Kozitsky and **D. Shoikhet**, Abel averages and holomorphically pseudo-contractive maps in Banach spaces. *Journal of Mathematical Analysis and Applications*, *423*, 1580-1593, 2015.

F. Bracci, M. Levenshtein, S. Reich and **D. Shoikhet**, Growth estimates for the numerical range of holomorphic mappings and applications. *Computational Methods and Function Theory*, DOI 10.1007/s40315-015-0155-6, 2015.

U. Brauer and **L. Karp,** Elliptic equations in weighted Besov spaces on asymptotically flat Riemannian manifolds. *Manuscripta Mathematica*, *148*(1), 59-97, 2015.

D. Burg, D. Malkinson, G. Katriel and **L. Wittenberg**, Modeling the dynamics of soil erosion and vegetative control – Catastrophe and hysteresis. *Theoretical Ecology, 8*, 67-79, 2015.

M. Chmutov, C. Hoyt and **S. Reif,** The Kac Wakimoto character formula for the general linear Lie superalgebra. *Algebra and Number Theory*, *9*, 1419-1452, 2015.

M. Demuth, F. Hanauska, M. Hansmann and **G. Katriel**, Estimating the number of eigenvalues of linear operators on Banach spaces. *Journal of Functional Analysis*, *268*, 1032-105, 2015.

A. Gibali, S. Reich and **R. Zalas,** Iterative methods for solving variational inequalities in Euclidean space. *Journal of Fixed Point Theory and Applications 17*, 775-811, 2015.

A. Gibali, A new non-Lipschitzian projection method for solving variational inequalities in Euclidean spaces. *Journal of Nonlinear Analysis and Optimization: Theory and Applications*, *6*, 41-51, 2015.

A. Gibali, K.-H. Küfer and **P. Süss,** Reformulating the Pascoletti-Serafini problem as a bi-level optimization problem. *Contemporary Mathematics*, *636*, 121-129, 2015.

V. Y. Glizer and **O. Kelis,** Solution of a zero-sum linear-quadratic differential dame with singular control cost of minimizer. *Journal of Control and Decision*, *2*, 2015. DOI: 10.1080/23307706.2015.1057545. 155-184.

V. Y. Glizer and **V. Turetsky,** Increasing pursuer capturability by using hybrid dynamics, *International Journal of Applied Mathematics & Computer Science*, *25*, Special Issue "Safety, Fault Diagnosis and Fault Tolerant Control in Aerospace Systems", 78-92, 2015.

V. Y. Glizer, V. Turetsky and **E. Bashansky**, Statistical process control optimization with variable sampling interval and nonlinear expected loss. *Journal of Industrial and Management Optimization*, *11*, 105-133, 2015.

A. Goldvard and **L. Karp**, On the composition of rotations in . *Journal Geometry and Symmetry in Physics*, *39*, 33-44, 2015.

L. Karp, Asymptotic properties of unbounded quadrature domains the plane, *European Journal of Applied Mathematics, 26*, 175-191, 2015.

G. Katriel, Directed random market: The equilibrium distribution. Acta Applicandae Mathematicae, *139*, 95-103, 2015.

G. Katriel, The immediate exchange model: An analytical investigation. *European Physical J*ournal *B*, 88, *19*, 1-6, 2015.

J. Shinar, V. Y. Glizer and **V. Turetsky,** Terminal state distribution of continuous-time system with random disturbance and noise-corrupted information. *IAEng International Journal of Applied Mathematics*, *45*, 77-84, 2015.

V. Turetsky, Book review: "Mathematical Game Theory and Applications" by Vladimir Mazalov, *International Game Theory Review*, *17*, 1580001-1-1580001-3, 2015.

A. Zvuloni, Y. Artzi-Randrup, G. Katriel, Y. Loya and **L. Stone,** Modeling the impact of white-plague coral disease in climate change scenarios. *PloS Computational Biology*, *11*, e1004151, 2015.

B. Abramovitz, M. Berezina and **A. Berman,** Learning to prove: From examples to general statements. *International Journal of Mathematical Education in Science and Technology, 45*(8), 1233-1248, 2014.

G. Avigad, A. Goldvard and **S. Shaul,** Time-response-based evolutionary optimization. *Engineering Optimization*, manuscript ID GENO-2013-0256.R3, April 2014.

T. Ya. Azizov, V. A. Senderov and **V. A. Khatskevich**, Strict and bistrict plus-operators. *Journal of Mathematical Sciences*, *200*, 295-304, 2014.

F. Bracci, M. Elin and **D. Shoikhet**, Growth estimates for pseudo-dissipative holomorphic maps in Banach spaces. *Journal of Nonlinear and Convex Analysis*, *15*, 191-198, 2014.

M. Elin, M. Levenshtein, S. Reich and **D. Shoikhet,** Some inequalities for the horosphere function and hyperbolically nonexpansive mappings on the Hilbert ball. *Journal of Mathematical Sciences, 201*, 595-613, 2014.

F. Bracci and **D. Shoikhet**, Boundary behavior of infinitesimal generators in the unit ball, *Transactions of AMS, 366*, 1119-1140, 2014.

O. Barnea, A. Huppert, G. Katriel and **L. Stone,** Spatio-temporal synchrony of influenza in cities across Israel: The "Israel is one city" hypothesis. *PLoS ONE*, 9, e91909, 2014.

U. Brauer and **L. Karp,** Local existence of solutions of self gravitating relativistic perfect. *Communications in Mathematical Physics, 325*, 105-141, 2014.

M. Elin and **F. Jacobzon**, Parabolic type semigroups: Asymptotics and order of contact. *Analysis* and *Mathematical Phys*ics, 2014. DOI Number: 10.1007/s13324-014-0084-y.

M. Elin and **M. Levenshtein,** Covering results and perturbed Roper-Suffridge operators. *Complex Analysis and Operator Theory, 8*, 25-36, 2014.

A. Frolova, M. Levenshtein, D. Shoikhet, and **A. Vasil'ev,** Boundary distortion estimates for holomorphic maps, *Complex Analysis and Operator Theory,* 8, 1129-1149, 2014.

G. Katriel, Convergence to an exponential distribution in a random market model, *Applicable Analysis*, *6*, 1256-1263, 2014.

G. Katriel, Gambler's ruin: The Duration of play. *Stochastic Models*, *30*, 251-271, 2014.

S. Reif, Denominator identity for twisted affine Lie superalgebra. *International Mathematics Research Notices, 4*, 4146-4178, 2014.

J. Shinar, V. Y. Glizer and **V. Turetsky,** Solution of a singular zero-sum linear-quadratic differential game by regularization, *International Game Theory Review*, Special Issue dedicated to the memory of Professor Nikolay Nikolaevich Krasovsky (1924–2012), *16*, 1440007-1–1440007-32, 2014.

J. Shinar, V. Y. Glizer and V. Turetsky, Capture zone of linear strategies in interception problems with variable structure dynamics, *Journal of the Franklin Institute*, Special Issue on 2010-2012 Advances in Variable Structure Systems and Sliding Mode Algorithms, *351*, 2378-2395, 2014.

V. Turetsky, V. Y. Glizer and **J. Shinar,** Robust trajectory tracking: Differential game/cheap control approach. *International Journal of Systems Science*, *45*, 2260-2274, 2014.

ACCEPTED FOR PUBLICATION

G. Ben Simon, M. Burger, T. Hartnick, A. Iozzi and **A. Wienhard**, On weakly maximal representations of surface groups. *Journal of Differential Geometry*, (accepted) 2013.

V. Bolotnikov, M. Elin and **D. Shoikhet**, Boundary asymptotic expansions of analytic self-mappings of the unit disk. *Annali della Scuola Normale Superiore Pisa,* DOI Number: 10.2422/2036-2145.201308_001.

M. Chmutov, R. Karpman and **S. Reif,** A superdimension formula for gl(m|n) modules. *Journal of Algebra Applications, 2015*. DOI: 10.1142/S0219498816500808.

M. Elin and **D. Shoikhet,** The radii problems for holomorphic mapping in J*-algebras. *Operator Theory*, Birkhouser.

T. Gadrich and **G. Katriel,** A mechanistic stochastic Ricker model: Analytical and numerical investigations. *International Journal of Bifurcation & Chaos.*

V. Turetsky, Robust route realization by linear-quadratic tracking. *Journal of Optimization Theory and Applications*.

V. Turetsky and E. Bashansky, Proficiency testing: Binary data analysis. *Accreditation and Quality Assurance*.

PREPRINTS

M. N. Berman and **M. Schein**, On the properties of pro-isomorphic zeta functions of groups under base extension.

M. N. Berman, B. Klopsch and **U. Onn,** On pro-isomorphic zeta functions of D*-groups of even Hirsch length. Preprint: arXiv:1511.06360.

M. N. Berman, B. Klopsch and **U. Onn,** A family of class-2 nilpotent groups, their automorphisms and pro-isomorphic zeta functions. Preprint: arXiv:1511.07418.

A. Gibali, D. Shoikhet and **N. Tarkhanov,** On the convergence of continuous Newton method. Preprints des Instituts fr Mathematik der Universitat Potsdam 4 (2015) 10.

M. Chmutov, C. Hoyt and **S. Reif,** Character formulas and piecewise disconnected representations for gl(m|n), arXiv:1407.0198.

U. Brauer and **L. Karp,** Local existence of solutions to the Euler-Poisson system, including densities without compact support, http://arxiv.org/abs/1511.0561

F. Jacobzon, Open problems related to asymptotic behavior of one-parameter continuous semigroups, (survey). Preprint, 2015

M. Elin and **F. Jacobzon**, Analyticity of semigroups in the right half-plane. Submitted for publication, arXiv:1511.04734, 2015.

BOOKS AND CHAPTERS IN BOOKS

M. Agranovsky, M. Ben–Artzi, D. Khavinson, G. Galloway, L. Karp, Reich, D. Shoikhet, G. Weinstein and **L. Zalcman (Ed.),** Complex analysis and dynamical systems VI, Part1: PDE, differentil geometry and radon transform. *Contemporary Mathematics*, *653*, American Mathematical Society, 2015.

M. Elin, F. Jacobzon, M. Levenshtein and **D. Shoikhet**, The Schwarz lemma. Rigidity and dynamics. In: *Harmonic and complex analysis and applications*. Basel: Birkhäuser, 135-230, 2014.

J. Shinar, V. Y. Glizer and **V. Turetsky,** The effect of pursuer dynamics on the value of linear pursuit-evasion games with bounded controls. In: V. Krivan and G. Zaccour (Eds.), Advances in dynamic game theory –Theory, applications and numerical methods. *Annals of the International Society of Dynamic Games*, *13*, Basel: Birkhauser, 313-350, 2013.

REFEREED CONFERENCE PROCEEDINGS

V. Y. Glizer and **V. Turetsky**, Linear-quadratic pursuit-evasion game with zero-order players' dynamics and terminal constraint for the evader. IFAC – Papers OnLine, Vol. 48, Issue 25, *Proceedings of the16th IFAC Workshop on Control Applications of Optimization CAO' 2015, Garmisch-*

Partenkirchen, (edited by Stefan Wolfgang Pickl and Martin Zsifkovits), pp. 22-27, 6-9 October, 2015.

J. Shinar, V. Y. Glizer and **V. Turetsky,** Fault-tolerant robust capture zone with respect to two faults. *Proceedings of the IEEE International Conference on Automation Science and Engineering*, pp. 1036-1041, Gothenburg, Sweden, August, 2015.

V. Y. Glizer and **V. Turetsky,** Optimal schedule of a statistical process control with a nonlinear expected loss. *Proceedings of the 7th Multidisciplinary International Conference on Scheduling: Theory and Applications*, pp. 42-54, Prague, Czech Republic, August, 2015. ISSN 2305 – 249X.

V. Y. Glizer and **O. Kelis,** Solution of a singular infinite horizon zero-sum linear-quadratic differential game: A regularization approach. *Proceedings of 23rd Mediterranean Conference on Control and Automation (MED),* pp. 390-397, Torremolinos, Spain, 16-19 June, 2015. DOI: 10.1109\ MED.2015.7158780.

B. Abramovitz, M. Berezina and **A. Berman,** Teaching students to prove by using online homework, *Proceedings of 12th International Conference "The Future of Mathematics Education in a Connected World"*, Herceg Novi, 2014.

V. Y. Glizer and **V. Turetsky,** Optimal quadratic control of linear time delay systems: One approach to numerical solution. *Proceedings of the 11th IEEE International Conference on Control & Automation (ICCA)*, pp. 797-802, Taichung, Taiwan, June, 2014.

V. Y. Glizer and **V. Turetsky,** Limit behavior of LQG control problem with small noise in observation and some aerospace application. *Proceedings of the 3rd International Conference on Mechanical Engineering and Mechatronics*, pp. 62.1-62.9, Prague, Czech Republic, August, 2014.

J. Shinar and **V. Turetsky,** "Time-to-go adaptive" estimation in interception endgames. *54th Israel Annual Conference on Aerospace Sciences*, Tel Aviv – Haifa, Israel, February, 2014.

J. Shinar, V. Turetsky and **V. Y. Glizer,** Fault-tolerant robust capture zone construction: Hybrid dynamics approach. *Proceedings of the 2014 IEEE 28th Convention of Electrical and Electronics Engineers in Israel*, pp. 1-5, Eilat, Israel, December, 2014.

V. Turetsky, J. Shinar and **A. Goldenshluger**, Novel switch detection algorithm in logic-based guidance. *Proceedings of the 2014 Joint Statistical Meetings,* pp.505-518 , Boston, MA, USA, August, 2014.

A. Berman, B. Koichu, L. Shvartsman, The undersdanding understanding equivalence of matrices, *Proceedings of CERME 8*, pp. 2296-2305, Antalya, Turkey, 2013.

S. Salomon, C. Dominguez-Medina, G. Avigad, A. Freitas, A. Goldvard, G. Rudolph, O. Schutze and **H. Trautmann**, PSA based multi-objective evolutionary algorithms. *EVOLVE – A Bridge between Probability, Set Oriented Numerics and Evolutionary Computation III, Advances in Intelligent Systems and Computing*, 500, pp. 233-259, 2013**.**

ORAL PRESENTATION AT INTERNATIONAL CONFERENCES

M. Elin, Extension of semigroups. *International Conference on Differential & Difference Equations and Applications*, Amadora, Portugal, May, 2015.

M. Elin, Extension operators in geometric function theory. *7th International Conference on Mathematical Analysis, Differential Equations and Their Applications (MADEA 7)*, Baku, Azerbaijan, September, 2015.

V. Y. Glizer and **V. Turetsky,** Linear-quadratic pursuit-evasion game with zero-order players' dynamics and terminal constraint for the evader. *16th IFAC Workshop on Control Applications of Optimization CAO' 2015,* Garmisch-Partenkirchen, Germany, October, 2015.

L. Karp, Some remarks on evolutions equations in general relativity. *Guangdong University of Finance Guangzhou*, August, 2015.

L. Karp, On the Euler-Poisson equations. *10th International ISAAC Congress*, Macao, August, 2015.

L. Karp, Asymptotic properties of quadrature domains in the plane. *10th International ISAAC Congress*, Macao, August, 2015.

J. Shinar, **V. Turetsky** and V. Y. Glizer, Fault-tolerant robust capture zone with respect to two faults. *IEEE International Conference on Automation Science and Engineering*, Gothenburg, Sweden, August, 2015.

V. Turetsky and V. Y. Glizer, Linear-quadratic pursuit-evasion game with terminal constraint for the evader. *10th International ISDG Workshop*, Glasgow, United Kingdom, July, 2015.

M. Elin, Local geometry of trajectories of parabolic type semigroups, *17th Conference on Analytic Functions and Related Topics*, Chełm, Poland, 29 June-2 July, 2014.

M. Elin, Some inequalities for angular derivatives. *Workshop on Analytic Functions and Applied Mathematics*, Rzeszow, Poland, July, 2014.

M. Elin, Angular derivatives of holomorphic self-mappings. *10th International Symposium on Geometric Function Theory and Applications*, Oradea, Romania, August, 2014.

L. Karp, Elliptic equations in weighted Besov spaces on asymptotically flat Riemannian manifolds. *Workshop Geometric and Singular Analysis*, Potsdam, Germany, March, 2014.

G. Katriel, Equilibrium distributions of some kinetic exchange models. *Israel Mathematical Union — American Mathemacial Society, 2nd International Joint Meeting*, June, 2014.

J. Shinar, **V. Turetsky** and V. Y. Glizer, Fault-tolerant robust capture zone construction: Hybrid dynamics approach. *2014 IEEE 28th Convention of Electrical and Electronics Engineers in Israel*, Eilat, Israel, December, 2014.

V. Turetsky, J. Shinar and A. Goldenshluger, Novel switch detection algorithm in logic-based guidance, *2014 Joint Statistical Meetings,* Boston, MA, USA, August, 2014.

NON REFEREED CONFERENCE PROCEEDINGS AND ABSTRACTS

E. Bashansky and **V. Turetsky**, A novel method to deal with latent ability testing and evaluation. *European Network for Business and Industrial Statistics*, Prague, Czech Republic September, 2015.

E. Bashansky and **V. Turetsky**, Estimating latent ability from the NDT results, when the test items difficulties are unknown beforehand. *21st World Congress IMEKO*, pp. 1881-1884, Prague, Czech Republic, 30 August– 4 September, 2015.

A. Goldvard, On the composition of finite rotations in . *11th ORT Braude College Interdisciplinary Research Conference*, 2015.

G. Katriel, Bounding the number of eigenvalues of some linear operators in Banach spaces. *10th ORT Braude College Interdisciplinary Conference*, 2015.

J. Shinar and V. Turetsky, Innovative estimator design for interception endgames. *Workshop on Optimization and Control*, Israel Aerospace Industries, Israel, January, 2015.

V. Turetsky and **E. Bashansky**, Estimating latent ability from the non-destructive test results when the test items difficulties are unknown beforehand. *2015 Joint Statistical Meetings*, Seattle, WA, USA, August, 2015.

V. Turetsky and **V. Y. Glizer,** Linear-quadratic pursuit-evasion game with terminal constraint for the evader. *10th International ISDG Workshop*, Glasgow, United Kingdom, July, 2015.

G. Katriel, Equilibria of kinetic exchange models. *10th ORT Braude College Interdisciplinary Conference*, 2014.

J. Shinar, V. Y. Glizer and **V. Turetsky,** Robust pursuit of a hybrid evader by a hybrid pursuer. *16th ISDG Symposium*, Amsterdam, The Netherlands, July, 2014.

V. Turetsky and **E. Bashansky**, A possible approach to one-dimensional latent X-abilty testing and evaluation. *10th ORT Braude College Interdisciplinary Research Conference*, Nahariya, Israel, October, 2014.

GRANTS

M. Elin, G. Katriel, **Y. Kozitsky**, **M. Levenshtein, D. Shoikhet and A. Vasil'ev,** Structure and evolution of complex systems with applications in physics and life sciences. European Union Grant for IRSES (FP7), grant number 612669, 2013.

JOURNAL REFEREE

B. Abramovitz

International Journal of Mathematical Education in Science and Technology

M. Elin

Complex Analysis and Operator Theory
Journal of Fixed Point Theory and Application
Complex Variables and Elliptic Equations
Journal of Mathematical Analysis and Applications
Annales Polonici Mathematici
Analysis and Mathematical Physics
Abstract and Applied Analysis
Indian Journal of Mathematics
Annales Universitatis Mariae Curie-Skłodowska
Journal d'Analyse Mathématique

A. Gibali

Abstract and Applied Analysis
Fixed Point Theory and Applications
Applied Mathematics and Mechanics
Inverse Problems
Journal of Inequalities and Applications
Computational Optimization and Applications
Inverse Problems in Science & Engineering
Nonlinear Analysis: Theory, Methods & Applications
Bulletin of Mathematical Analysis and Applications
Journal of Global Optimization
Mathematical Modelling and Analysis
Numerical Algorithms
Optimization letters

L. Karp

Proceedings Mathematical Sciences
Journal of Mathematical Analysis and Applications
Analysis and Mathematical Physics
Complex Variables and Elliptic Equations

H. Katriel

Chaos, Soliton& Fractals
Statistical Methods in Medical Research
Chaos
Nonlinear Analysis
European J of Applied Mathematics
Abstract and Applied Analysis
Advanced Nonlinear Studies

V. Turetsky

Operations Research Letters
International Journal on Applied Mathematics and Computer Science
International Journal of Control
International Game Theory Review
Automatica

INVITED TALKS

A. Gibali

Colloquium talk, Heidelberg Collaboratory for Image Processing (HCI), University of Heidelberg, Heidelberg, Germany, July 2015.

H. Katriel

Weizmann Institute, Mathematical Analysis and Applications Seminar, December 2014
Technion, PDE and Applied Mathematics Seminar, June 2015

Department of Mechanical Engineering

Prof. Ehud Koll, D.Sc.,
Head of the Department

RESEARCH AREAS

A PRESCRIPTIVE MODEL OF THE CONCEPTUAL ENGINEERING DESIGN PROCESS BASED ON PARAMETER ANALYSIS AND C-K THEORY

Ehud Kroll and **Gil Weisbrod** (Technion—Israel Institute of Technology)

The objective of this research is to propose a new prescriptive model for conceptual engineering design based on a methodology called Parameter Analysis and a relatively new descriptive model called C-K Theory. Parameter Analysis began in the 1970s at MIT as a training methodology for innovators, and has been developed for the last 20 years into a prescriptive model with clear and distinct steps. These steps lead the designer through the process of starting with a rough idea and turning it into an elaborate conceptual design of a realizable product. Parameter Analysis, however, lacks in not having a strong theoretical foundation, so it is difficult to establish its "correctness" and its relation to other design methodologies and tools. C-K Theory has gained a reputation for being a very general descriptive model of the design process, encompassing everything from the initial need statement, through generation of new scientific knowledge, to yielding breakthrough designs. It seems especially suitable to capture highly innovative design processes. C-K Theory, however, lacks in its prescriptive aspect: it can explain quite well the activities during design, but does not guide the designer as to what to do next at any given moment. This research, therefore, studies Parameter Analysis in light of C-K Theory and vice versa, using a multitude of case studies in which both models have been and will be applied. The goal is to generate a new prescriptive model of conceptual engineering design that will include the benefits of both Parameter Analysis and C-K Theory. Our object is to obtain a model comprising a clear and concise step-by-step procedure that is conducive to teaching and practicing design,

and at the same time, rooted in a theoretical foundation to support its scientific validity and allow comparison with other design models. The expected significance of this research is the contribution to the theory and practice of engineering design, eventually leading to improved design processes and better designed products.

Keywords: Conceptual design, parameter analysis, C-K theory

ABDUCTION IN DESIGN

Ehud Kroll and **Lauri Koskela** (University of Huddersfield, UK)

The pragmatist philosopher Peirce defined abduction as the only type of inference capable of producing a new idea. Influenced by Peirce's seminal writings and subsequent treatments on abduction in the philosophy of science, in the last 40 years, design scholars have endeavored to shed light on design by means of the concept of abduction. A review and an evaluation of the related literature, however, suggest that research into abduction in design is still undeveloped. This research shows gaps in coverage, lack of depth and diverging outcomes. The difficulties at hand may be the cause of this situation: Diverging developments of the concept of abduction in the philosophy of science, the differences in context between science and design, and the embryonic state of the science of design itself. By focusing on the differences between science and design as well as on empirical knowledge on different phenomena comprising design, new conceptions of abduction in design are derived. Given the differences of context, proponents contend that abduction in design can show characteristics not found or still unidentified in science. Design abduction may emerge in any part of the design process. Abduction can occur in connection to practically all inference types in design. It is a property of an inference besides being an inference itself. Abduction usually leads to an idea new to the context. The main criterion of an abduced insight in design is its utility. A number of the most important abductive inference types as they occur in design are studied in more detail, thus covering regressive inferences, composition, transformation, manipulative abduction, decomposition, analogical reasoning and invention of requirements.

Keywords: Abduction, innovative abduction, design reasoning

CHARCTERISTICS OF SEPARATED LAMINAR FLOWS IN INCLINED PIPES

Ayelet Goldstein (Mechanical Engineering, Ort Braude College)**, Amos Ullmann** (Tel Aviv University) and **Neima Brauner** (Tel Aviv University)

Exact solutions for separated two-phase flow are useful as benchmarks for numerical codes and for testing closure relations for simplified 1D two-fluid (TF) models. Recently, we obtained a complete set of exact solutions for laminar flows in inclined pipes. These include all possible configurations of stratified flows (STF) with concave and convex interfaces, and core-annular flows (CAF) with various core eccentricities. The exact solutions are used to analyze the local and averaged wall and interfacial shear stresses for these various flow geometries. A closed-form

analytical expression for the average interfacial shear stress was obtained for all cases of STF. The limiting behavior of the local shear stresses at the triple-point, where the interface meets the pipe wall, is determined by residue calculus. It is shown that the shear stress profiles in the vicinity of the triple points are determined by the fluids' viscosity ratio and the contact angle. The usefulness of the exact solutions for testing closure for approximate TF models is discussed. The future plan is to improve the prediction of stability boundaries of various separated flow configurations in the pipe geometry via two fluid models.

Keywords: Two-phase laminar stratified flow, two-phase core-annular flow, fully-eccentric flow, inclined pipes, curved interface, lubrication

TORREFACTION FOR BIOMASS UPGRADING

Ayelet Goldstein (Mechanical Engineering, Ort Braude College) and **Chaim Gutfinger** (Technion—Israel Institute of Technology)

Disposal of biomass (municipal green waste, agricultural residues, forestry residues, etc.) is a problem for farmers and municipalities. On the other hand, such material has significant calorific value and so the potential exists to turn a problem into an asset by converting it into electricity or a clean burning solid fuel. The research deals with converting such waste material into bio-coal by a process of heating in the absence of oxygen (torrefaction). Bio-coal can be burnt with regular coal in power stations or used as solid fuel in small steam-powered power plants.

Keywords: Torrefaction, pre-treatment

MODELING OF MICRO ELECTROMECHANICAL SYSTEMS (MEMS)

Samy Abu Salih

Modeling of micro electromechanical systems (MEMS) is a pivotal step in achieving maximum efficient design and high accuracy of micro systems (MEMS devices). My research focuses on:

- Electromechanical buckling of micro structures with application to MEMS devices
- Modeling the chemo-electro-mechanical response of micro hydrogel structures
- Modeling of the electromechanical response of micro piezoelectric sensors and actuators.

Keywords: Modeling of micro systems, MEMS, electromechanical buckling (EMB)

MECHANICS OF CAVITATION, PENETRATION, PERFORATION AND SHEILDING

Rami Masri

My research focuses on:

- Investigating the mechanics of deep penetration and ductile plate perforation of protective targets by rigid projectiles

- Investigating the mechanics of hole growth (cavity expansion) in protective plates under different conditions
- Investigating the mechanics of quasi-static and dynamic cavitation phenomena in different solids.

Keywords: Cavity expansion, cavitation, ductile hole growth, deep penetration, plate perforation, ballistic limit

MECHANICS OF METAL CUTTING AND PREDICTION OF TOOL-LIFE

Samy Abu Salih and **Rami Masri**

We focus on:

- Investigating the influence of cutting conditions, tool geometry and material properties on wear and tool-life
- Finite Element Analysis (FEA) of metal cutting and chip generation
- Investigating the effects of drilling vibration on the efficiency and number of drilled holes
- Establishing a metal cutting laboratory for conducting experiments in machining and metal cutting processes.

Keywords: Metal cutting, wear, chip generation, drilling with vibration, finite element analysis

DYNAMIC MIMICKING

Gideon Avigad, Avi Weiss and Uri Ben Hanan

This research focuses on creating a robot that can mimic the dynamics of another vehicle in real time. The problem is simple when the workspace of both the robot and the vehicle are the same, but in the case of mismatches in the workspace of the vehicles, the problem becomes one of optimization. A proof-of-concept demonstrator was built, and the system was patented. We are now looking at the prospect of commercialization. In addition, we are expanding research regarding compatibility of the system to various carrier robots with various workspaces as well as the robustness of the system.

Keywords: Wheelchair dynamics, robotics, maneuverability

FRICTION STIR WELDING (FSW)

Michael Regev and **Stefano Spigarelli** (Universita Politecnica delle Marche, Ancona, Italy)

Being a non-fusion welding process, friction stir welding (FSW) has many advantages over conventional welding processes. Among these advantages are the elimination of hot and cold

cracking and the ability to join non-weldable alloys. The processes of welding AZ31B to other alloys, e.g., AA6061, as well as welding AA2024, are studied together with the creep properties of the weld.

Keywords: Friction stir welding, magnesium alloys, AZ31

MG-BASED AMORPHOUS ALLOYS

Michael Regev and **Alexander Katz-Demyanetz** (Technion—Israel Institute of Technology)

Crystalline magnesium alloys are attractive due to their high strength-to-weight ratio. In addition, amorphous alloys offer high corrosion resistance and good mechanical properties. One drawback of amorphous alloys is the high cooling rates required to achieve an amorphous microstructure. Ongoing research in this area, therefore, focuses on the development of amorphous alloys that can be cast by conventional processes. Special attention is paid to the microstructure characterization by using advanced characterization tools such as High Resolution Transmission Electron Microscopy (HRTEM).

Keywords: Metallic glass, melt spinning, amorphization

MOLECULAR MODELING FOR POLYMERS

David Alperstein

This research focuses on a state-of-the-art software technique for predicting and analyzing plastics properties from basic principles to computer-aided simulations for plastics processing. The main interest is polymer-polymer blends and polymer-additive blends. Some research projects in this field include: Computational research of slow release drugs from a polymer matrix, computational research of plasticizers for Nylon6, and computational research of the interaction of carbon tubes with organic compounds.

Keywords: Molecular dynamics, molecular mechanics, amorphous cell, polymer chain

MOTOR FUNCTION IN ADHA

Orit Braun Benjamin and **Navit Roth**

Attention deficit and hyperactivity disorder (ADHD) is a common syndrome affecting 3-20% of children and has become a significant public health problem. These studies aim to investigate the posture stability by measuring center of pressure movements and their relation to dual tasks and cognitive load. Our initial results show that students with ADHD have larger center of pressure movements compared with non ADHD students. There is a striking elevation in the sway area of ADHD subjects when undergoing dual tasks and cognitive load.

Keywords: Attention deficit hyperactivity disorder, postural stability, single task, dual task

MULTI-OBJECTIVE GAMES

Erella Eisenstadt, **Gideon Avigad** and **Amiram Moshaiov** (Tel Aviv University)

This research focuses on the applications of evolutionary and co-evolutionary algorithms for solving multi-objective games under undecided objective preferences.

Keywords: Optimization, evolutionary computation, multi-criteria decision making

OMNIDIRECTIONAL MOTION PLATFORMS AND ROBOTICS

Avi Weiss

Motion platforms such as those popular in flight simulators are parallel manipulators that utilize six extensible legs to control six degrees of freedom. These platforms are able to bear heavy weights, but have a very limited range of motion, singularities in their workspace and highly coupled kinematics. This research focuses on developing, modeling, and optimizing the design of an omnidirectional motion platform with unlimited, singularity-free angular motion that is decoupled from the translational motion. Mobile robots utilizing omnidirectional wheels would be holonomic, thus able to exert full and instantaneous control over the pose of the robot without resorting to circumventing motion maneuvers that are not available for non-holonomic vehicles (such as lateral motion). A full-scale system was built at Carleton University in Canada, with a sphere diameter of 3 meters. It is now in the integration phase towards soon being functional. Current research focuses on vibration and control issues.

Keywords: Kinematics, dynamics, mobile robots, parallel manipulators, motion platforms, vibration

MECHANICAL COGNITIVIZATION

Gideon Avigad and **Avi Weiss**

The common approach to training robots is to expose them to different environmental scenarios, training their controllers to have the best possible command when untrained scenarios are encountered. When humans train, they do the same. They try new manipulations by performing within different environments. Human training (and in fact, development from infancy to maturity), however, also includes a type of training that although claimed to improve cognitive capabilities, has not, to date, been adopted for the training of robots. This type of training involves the restriction of manipulation capabilities while performing different tasks, e.g., climbing with just one hand. Recently, the results of a study that explored the invigorating idea that such training, termed mechanical cognitivization (MC), would enhance the robustness of robots, was published by us. This work demonstrated the idea by utilizing mathematical functions, not through a robotic system. The first proof that such training may enhance the robustness of robots was shown. Specifically, we showed that such training improves the performances of robots when they need to perform new tasks, when performing within untrained environments

and when malfunctions occur. The advantages and uses of the concept are at the core of this research direction.

Keywords: Cognitive robotics, developmental robotics, robustness

BIO-INSPIRED JUMPING-GLIDING ROBOT

Uri Ben Hanan, **Avi Weiss**, **Valentin Zaitsev**, **Gabor Kosa** (Tel-Aviv University), **Amir Ayali** (Tel-Aviv University), **Avishai Beck** (Tel-Aviv University) and **Omer Gvirtsman** (Tel-Aviv University)

Bio-inspired robotics is a promising design strategy for mobile robots. Jumping is an energy efficient locomotion gait for trespassing difficult terrain. Inspired by the jumping and flying behavior of the desert locust, we developed a jumping robot that is capable of opening its wings at the apex of the jump and gliding to the ground. The main advantages of this maneuver are the stabilization of the robot when airborne, the reduction of velocity at landing, the control of the landing angle, and the potential to change the robot's orientation and control its flight trajectory. Using this gait, the robot is capable of jumping to a height of 1.7 m and a distance of 4 m**.** The same robot without the wings jumps to a record height of 3.5 m.

Keywords: Bio-inspired robotics, jumping robot, gliding robot

COOPERATION OF TWO INVERTED PENDULUM MOBILE ROBOTS

Uri Ben Hanan and **Avi Weiss**

In manufacturing plants and automated warehouses, automated guided vehicles (AGVs) are widely used. AGVs are vehicles designed mainly to carry pallets with components or products from one spot to another while moving on a level floor. In most cases, they move along a guide path. More advanced AGVs are free-ranging, thus have a wider range of tasks. In addition, advanced AGVs have the ability to communicate with one another. Most AGVs are three- or four-wheeled platforms with base dimensions proportional to the height and weight of their maximal load for stability reasons—which limits their ability to traverse crowded areas and narrow corridors and passageways. Wheeled inverted pendulum robots have several advantages over AGVs: they have high maneuverability on flat surfaces due to their small base, and a self-balancing system such that height and weight of the payload do not have a significant effect on the base size. In fact, they can carry a higher payload for the same base size than AGVs. Our research focuses on modelling and design of two-wheeled inverted pendulum robots. Despite the aforementioned advantages, two-wheeled inverted pendulum robots have limited ability to overcome obstacles such as steps, and no ability to climb staircases or move in rough terrain. The complexity of the modern manufacturing floor requires a robot to have high maneuverability while being able to overcome obstacles such as a step or two, and sometimes an entire staircase. These are contradictory requirements, since maneuvering a crowded and narrow environment requires small robots, while overcoming obstacles such as stairs requires large robots. Our research spans the kinematic and dynamic analysis of a team of inverted pendulum robots with

respect to overcoming obstacles such as stairs, the ability of the robots to find one another in a manufacturing floor environment, and the control aspects of the physical connecting and driving together.

Keywords: Kinematics, dynamics, control, mobile robots, robot cooperation

CUTTING ZONE TEMPERATURE AND SPECIFIC CUTTING ENERGY MEASUREMENT AND EVALUATION IN MICRO MACHINING OF METALS AND CERAMICS

Yitzchak Yifrach, **Omri Levi** and **Elad Yehouda**

Knowledge about the temperature that develops between tools and raw material is needed for optimizing the cutting parameters. A controlled grinding experiment was compared with a thermo-mechanical finite elements model (FEM) simulating the temperature distributions and other effects occurring in the cutting zone. An electric grinding machine, controlled by Labview software, which kept the torque and rotational speed constant and prevented disruption of fixed air flow, was used.

The processed material is glass ceramics, low carbon steel, and aluminum 6061-T6, the mechanical and thermal properties of which are known from the literature. An FEM model was developed and its parameters determined by matching the computed nodes to the thermocouples' temperature measurements. The experiment was carried out by single slot cutting, without cooling. The cutting power value was based on specific cutting energy (U), known from the literature, and calculation of the material removal rate (MRR) from the cutting parameters (depth and width of cut, feed rate). The dynamic model simulated the movement of a cutting tool by sampling heat sources along the path. The fit obtained between the dynamic model and the measurements enables reliable calculation of the specific cutting energy (U) for every combination of tool cut and raw material.

Keywords: Cutting, specific cutting energy (U), material removal rate (MRR), finite element method (FEM)

STUDY OF THE STRESSES IN THE FEMORAL NECK WHILE PERFORMING A PELVIC LIFT

Orit Braun Benjamin, **Adi Toledano-Zahrchi** and **Dorit Itah**

Non-weight bearing of post-operative patients including pelvic lift may cause complications if there is prolonged bed rest. Calculating the evolving forces, moments and the associated stresses at the femoral neck while performing a pelvic lift may support the medical protocols used by orthopedics.

Keywords: Biomechanics, pelvic lift, femoral neck

UPPER HAND TREMOR DURING A WRITING TASK – DEVELOPMENT OF A MEASUREMENT SYSTEM

Navit Roth and **Orit Braun Benyamin**

A major motor limitations that exist in humans is the phenomenon of tremor. Tremor may be the outcome of chronic or neurological diseases and pharmacological toxicological background. Tremor occurs mostly in the upper limbs and the intensity (amplitude) and frequency level of tremor can vary throughout the day and may depend on stress level, amount of physiological effort of the relevant muscles, medication, movement characteristics and orientation of the limb. Tremor assessment and diagnosis is carried out by the doctor through general neurological and general examination and does not involve quantified measurement systems. Development of an accurate, reliable measuring system, with a self-test capability, will enable doctors and people suffering from tremor to evaluate the effect and efficiency of treatment on tremor characteristics by means of quantitative parameters.

This research aims to define and build a tremor measuring system while performing a writing task. The system will include and compare measurements from accelerometers, motion capture analysis of relevant points through digital video analysis and coordinates of the pen pointer, pen tilt and pen pressure measurements from a tablet system.

Keywords: Tremor, motion measurement, biomechanics

REFEREED PAPERS

G. Avigad, **W. Li** and **A. Weiss**, Mechanical cognitivization: A kinematic proof of concept. *Adaptive Behavior*, *23*(3) 155-170, 2015. DOI: 10.1177/1059712315584380.

D. Knani, **D. Alperstein**, **T. Kauth**, **D. Kaltbeitzel** and **C. Hopmann**, Molecular modeling study of CO2 plasticization and sorption onto absorbable polyesters. *Polymer Bulletin*, 72: 1467, 2015. doi:10.1007/s00289-015-1349-9.

R. Masri, Ballistically equivalent aluminum targets and the effect of hole slenderness ratio on ductile plate perforation. *International Journal of Impact Engineering, 80*, 45-55, 2015.

O. Muller, **N**. **Shalit**, and **O. Braun Benyamin**, Students of engineering on behalf of people with disabilities: Evaluating the impact of an institution's flagship project. *IEEE Frontiers in Education*, 1-5, 2015. DOI: 10.1109/FIE.2015.7344326.

A. Weiss, R. G. **Langlois** and **M. J. D. Hayes,** Dynamics and vibration analysis of the interface between a non-rigid sphere and omnidirectional wheel actuators. *Robotica*, *33*(9), 1850-1868, 2015. doi:10.1017/S0263574714001088

V. Zaytsev, O. Gvirsman, U. Ben-Hanan, A. Weiss, A. Ayali and **G. Kosa**, A locust-inspired miniature jumping robot. *Bioinspiration & Biomimetics*, *10*(6), 066012, 2015.

S. Abu-Salih, Analysis of thermo electromechanical buckling of micro annular plate. *Journal of Computational and Theoretical Nanoscience, 11*(4), 1-7, 2014.

D. Alperstein, **D. Knani**, **N. Borchmann**, **M. Spekowius** and **C. Hopmann**, Prediction of environmental stress cracking in polycarbonate by molecular modeling. *Polymers for Advanced Technologies*, 25, 1433-1438, 2014.

G. Avigad and **A. Weiss**, Enhancing robustness through mechanical cognitivization. *International Journal on Advances in Intelligent Systems*, *7*(3&4), 652-661, 2014.

O. Braun-Benyamin, J. Cohen and **S. Braun**, Controlling environmental interference via a 2-phase measurement strategy. *Measurement*, *47*(January), 234–239, 2014.

E. Kroll, P. Le Masson and **B. Weil**, Steepest-first exploration with learning-based path evaluation: Uncovering the design strategy of parameter analysis with C–K theory. *Research in Engineering Design, 25*(4), 351-373, 2014.

G. Leisman, **O. Braun-Benjamin**, and **R. Melillo**, Cognitive-motor interactions of the basal ganglia in development. *Frontiers in Systems Neuroscience*, *8*(16), 2014. doi: 10.3389/fnsys.2014.0016.

R. Masri, The effect of adiabatic thermal softening on specific cavitation energy and ductile plate perforation. *International Journal of Impact Engineering, 68*, 15-27, 2014.

S. Springer, **O. Braun-Benyamin**, **C. Abraham-Shitreet**, **M. Becher** and **Y. Laufer**, The effect of electrode placement and interphase interval on force production during stimulation of the dorsiflexor muscles. *Artificial Organs*, *8*, 2014. DOI: 10.1111/aor.12346

D. Alperstein and **D. Knani**, In silico studies of 1, 3(R):2,4(S)-dibenzylidene-D-sorbitol as a gelator for polypropylene**.** *Polymers for Advanced Technologies*, *24*, 391-397, 2013**.**

N. Howard and **G. Leisman,** DIME (diplomatic, information, military and economic power) effects modeling system: Dual use in brain small-world connectography and rehabilitation**.** *Functional Neurology, Rehabilitation, and Ergonomics***,** *3*(2-3), 257-274, 2013.

A. Kraitzer, D. Alperstein, Y. Kloog and **M. Zilberman**, Mechanisms of antiproliferative drug release from bioresorbable porous structures. *Journal of Biomedical Materials Research Part A*, *101A*, 1302-1310, 2013.

E. Kroll, Design theory and conceptual design: Contrasting functional decomposition and morphology with parameter analysis. *Research in Engineering Design*, *24*(2), 165-183 (special issue on design theory), 2013.

M. Regev and **S. Spigarelli**, Plastic deformation mechanisms of base material and friction stir welded AZ31B-H24 magnesium alloy. *Materials Sciences and Applications*, *4*, 357-364, 2013.

R. Rodriguez-Rojas, K. Batista, Y. Iturria, C. Machado, M. Chinchilla, M. Carballo, J. M. Morales, P. De Fina and **G. Leisman,** Disrupted axonal fiber connectivity as a marker of impaired consciousness states**.** *Functional Neurology, Rehabilitation and Ergonomics***,** *3*(2-3), 319-328, 2013.

E. Zelikman, D. Alperstein, G. Mechrez, R. Suckeveriene and **M. Narkis**, Study of interactions between single-wall carbon nanotubes and surfactant using molecular simulations. *Polymer Bulletin*, *70*, 1195-1204, 2013.

ACCEPTED FOR PUBLICATION

S. Sadik, A flow field between two oscillating plates with different amplitudes and frequencies. *Journal of Chinese Society of Mechanical Engineers*.

BOOKS AND CHAPTERS IN BOOKS

E. Kroll and **L. Koskela,** On abduction in design. In: J. S. Gero and S. Hanna (eds.), *Design Computing and Cognition '14,* chapter 19, pp. 327-344. Springer, 2015.

G. Avigad, E. Eisenstadt and **V. Y. Glizer**, Solution of multi-objective min-max and max-min games by evolution. In: R. C. Purshouse (Ed.), *Evolutionary multi-criterion optimization, Lecture notes in computer science 7811*, pp. 121–135. Berlin, Heidelberg: Springer, 2013.

S. Salomon, **G. Avigad**, **P. Fleming** and **R. Purshouse**, Optimization of adaptation: A multi-objective approach for optimizing changes of design parameters. In: R. C. Purshouse (Ed.), *Evolutionary multi-criterion optimization, Lecture notes in computer science 7811*, pp. 21–35. Berlin, Heidelberg: Springer, 2013.

REFEREED CONFERENCE PROCEEDINGS

S. Abu Salih, An analytical study of electromechanical buckling of micro spherical thin film bonded to a spherical compliant substrate. *3rd Polish Congress of Mechanics & 21st International Conference on Computer Methods in Mechanics (PCM-CMM-2015)*, Gdansk, Poland, September, 2015.

E. Kroll and **G. Weisbrod,** A search and optimization perspective on conceptual design. *International Conference on Engineering Design (ICED'15)*, Milan, Italy, 27-30 July, 2015**.**

A. Weiss, R. G. Langlois, and **M.J.D. Hayes**, The atlas spherical motion platform. *Israeli Conference of Mechanical Engineering, ICME 2015*, Tel Aviv, March, 2015.

V. Zaitsev, O. Gvirtsman, U. Ben Hanan, A. Weiss, A. Ayali and **G. Kosa**. Locust-Inspired miniature jumping robot. *2015 IROS – IEEE/RSJ International Conference on Intelligent Robots and Systems*, Hamburg, Germany, 28 September-2 October, 2015.

G. Avigad and **A. Weiss**, Mechanical cognitivization. *COGNITIVE 2014*, Venice, Italy, 25-29 May, 2014. (Won best paper award.)

E. Kroll and **L. Koskela**, On abduction in design. *6th International Conference on Design Computing and Cognition (DCC'14)*, London, UK, 23-25 June, 2014.

E. Kroll and **I. Farbman**, Learning from the design methodology of famous aerospace innovators. *29th Congress of the International Council of the Aeronautical Sciences (ICAS)*, St. Petersburg, Russia, 7-12 September, 2014.

A. Weiss, G. Avigad and **U. Ben Hanan**, Enhancing wheelchair mobility through dynamics mimicking. *Proceedings of the 3rd International Conference on Mechanical Engineering and Mechatronics*, Prague, Czech Republic, 14-15 August, 2014.

E. Kroll, P. Le Masson, and **B. Weil**, Modeling parameter analysis design moves with C-K theory. *International Conference on Engineering Design (ICED'13)*, Seoul, 19-22 August, 2013.

M. Regev and **S. Spigarelli**, Plastic deformation mechanisms operating in parent metal and friction stir welded AZ31B magnesium alloy. *Conference Proceedings of the 7th Asia Pacific IIW International Conference*, Singapore, pp. 523-527, 2013.

A. Weiss and **G. Avigad**, Optimal design of a pair of cooperating robots by kinetic analysis of stair climbing states. *ECCOMAS Multibody Dynamics*, Zagreb, Croatia, July, 2013.

A. Weiss, G. Avigad and **U. Ben Hanan**, Enhancing wheelchair maneuverability by dynamics mimicking. *Israeli Conference on Robotics*, Tel Aviv, Israel, November, 2013.

V. Zaytsev, A. Weiss, U. Ben Hanan, A. Ayali and **G. Kosa**, A biomimetic jumping robot. *Israeli Conference on Robotics*, Tel Aviv, Israel, November, 2013.

ORAL PRESENTATION AT INTERNATIONAL CONFERENCES

E. Kroll and L. Koskela, On abduction in design. *6th International Conference on Design Computing and Cognition (DCC'14)*, London, UK, 23-25 June, 2014.

E. Kroll and I. Farbman, Learning from the design methodology of famous aerospace innovators. *29th Congress of the International Council of the Aeronautical Sciences (ICAS)*, St. Petersburg, Russia, 7-12 September, 2014.

D. Alperstein and D. Knani, Toward computational design of efficient plasticizers for nylon. *42th Annual Meeting of the Israeli Polymer and Plastics Society*, Tel Aviv, Israel, 5 December, 2013.

G. Avigad, E. Eisenstadt, and V. Y. Glizer, Solution of multi-objective min-max and max-min games by evolution. *Evolutionary Multi-Criterion Optimization, (EMO 2013)*, Sheffield, UK, 19-22 March, 2013.

E. Kroll, P. Le Masson and B. Weil, Modeling parameter analysis design moves with C-K theory. *International Conference on Engineering Design (ICED'13)*, Seoul, South Korea, 19-22 August, 2013.

G. Leisman, Optimization methodology and functional connectivities inform the cognitive modifiability in the rehabilitation of developmental language difficulties. Plenary Paper presented at the *Conference on Cognitive Modifiability*, Jerusalem, Israel, 3-5 June, 2013.

M. Regev and S. Spigarelli, Plastic deformation mechanisms operating in parent metal and friction stir welded AZ31B magnesium alloy. *7th Asia Pacific IIW International Conference*, Singapore, 8-10 July, 2013.

Y. Yifrach, Cutting zone temperature and specific cutting energy measurement and evaluation in machining Metals. *13th International Conference on Fracture (ICF13)*, Beijing, China, 16–21 June, 2013.

NON REFEREED CONFERENCE PROCEEDINGS AND ABSTRACTS

S. Abu Salih, Non-Fourier heat conduction analysis with application to vibrational drilling in composite materials**",** *10th ORT Braude College Interdisciplinary Research Conference*, Nahariya, Israel, September, 2014.

GRANTS

G. Avigad, FP7-IRSES project: New horizons for multi-criteria decision making, 2012-2015 (accepted in 2011), EU consortium coordinator.

E. Kroll, Israel Science Foundation: A prescriptive model of the conceptual engineering design process based on parameter analysis and C-K theory. 1 October, 2012-30 September, 2016, app. $100,000.

G. Leisman, Kamea Dor-Bet: Establishment of the Institute for Brain and Rehabilitation Sciences, 2011-2016.

O. Braun Benyamin, Council for Higher Education: Participation of students and academia in community oriented projects (rehabilitation biomechanics), 2015.

O. Braun Benyamin, Council for Higher Education: Participation of students and academia in community oriented projects (advanced engineering design), 2015.

O. Braun Benyamin, Rehabilitation Knowledge Center at ORT Braude College, Partnership2Gether Karmiel– Misgav–Pittsburgh, 2015.

N. Shalit and **O. Braun Benyamin**, Flagship Project: Rehabilitation Knowledge Center at ORT Braude College, Council for Higher Education: Participation of students and academia in community oriented projects, 2015.

O. Braun Benyamin, Rehabilitation Knowledge Center at ORT Braude College, Partnership2Gether Karmiel–Misgav–Pittsburgh, 2014.

O. Braun Benyamin, Council for Higher Education: Participation of students and academia in community oriented Projects (rehabilitation biomechanics), 2014.

O. Braun Benyamin, Council for Higher Education, Participation of students and academia in community oriented projects (advanced engineering design), 2014.

N. Shalit and **O. Braun Benyamin**, Flagship Project: Rehabilitation Knowledge Center at ORT Braude College, Council for Higher Education: Participation of students and academia in community oriented projects, 2014.

O. Braun Benyamin, Council for Higher Education: Participation of students and academia in community oriented projects (rehabilitation biomechanics), 2013.

O. Braun Benyamin, Council for Higher Education: Participation of students and academia in community oriented projects (advanced engineering design), 2013.

N. Shalit and **O. Braun Benyamin**, Flagship Project: Rehabilitation Knowledge Center at ORT Braude College, Council for Higher Education: Participation of students and academia in community oriented projects, 2013.

JOURNAL REFEREE

G. Avigad

IEEE Transactions on Evolutionary Computation,
IEEE Transactions on Systems Man and Cybernetics – Part B
Journal of Engineering Design
Engineering Optimization,
Research in Engineering Design

O. Braun Benyamin

Journal of Functional Neurology, Rehabilitation, and Ergonomics

E. Kroll

Artificial Intelligence for Engineering Design, Analysis and Manufacturing (AIEDAM)
International Journal of Design Creativity and Innovation
Journal of Engineering Design
Resources, Conservation & Recycling
Research in Engineering Design
Rapid Prototyping Journal

G. Leisman

Editorial Boards
Editor-in-Chief, Journal of Functional Neurology, Rehabilitation, and Ergonomics
Neural Regeneration Research
Journal of Manipulative & Physiological Therapeutics
Applied Kinesiology Review
Psychiatry-on-Line
Behavioral & Brain Sciences Associate
Frontiers of Child Health and Human Development Co-Editor, IEEE Computers in Medicine Technical Report
Consulting Neuroscience Editor:
Medcom Publishers
American Association for the Advancement of Science
Springer Verlag
Academic Press
Energy Medicine
Reviewer:
Science
Behavioral and Brain Sciences
Cortex
Neuroscience Letters
Cerebral Cortex
IEEE Journal Computer
Educational Research
IEEE Press
International Neuropsychological Society
Neural Regeneration Research
Psychiatry-on-Line
Association for Psychological Science
Learning & Individual Differences

Perceptual and Motor Skills
Scientific World Journal
Journal of Growth & Human Development
International Journal of Adolescent Medicine
International Journal of Disability and Human Development
Frontiers of Child Health and Human Development

M. Regev

Journal of Materials Science
Physica Status Solids
Materials Science and Engineering B.

R. Masri

International Journal of Impact Engineering

A. Weiss

Robotica
Assistive Technology

INVITED TALKS

E. Kroll, P. Le Masson and B. Weil, Steepest-first exploration with learning-based path evaluation: Uncovering the design strategy of parameter analysis with C–K theory. An invited presentation at the *7th International Workshop of the Design Theory Special Interest Group of the Design Society*, *Mines ParisTech*, Paris, France, 28 January, 2014.

E. Kroll, Modeling pragmatic design moves with C-K theory. An invited presentation at the *6th International Workshop of the Design Theory Special Interest Group of the Design Society, Mines ParisTech*, Paris, France, 5 February, 2013.

Department of Physics & Optical Engineering

Prof. Jorge Berger, D.Sc.,
Head of the Department

RESEARCH AREAS

HIGH ENERGY ASTROPHYSICS

Dafne Guetta

We study the physics and redshift distribution of gamma-ray bursts (GRBs), bursts of 0.1-1 MeV photons lasting for few seconds. These are very energetic sources that can be used to probe the star formation rate. We study the high energy neutrino and gravitational wave emission from GRBs and other astrophysical sources, such as microquasars. We are interested in understanding what the sources of ultra-high energy cosmic rays are and if hadrons are present in the jets of these sources.

Keywords: Neutrino particle, gamma rays

HIGH TEMPERATURE SUPERCONDUCTIVITY (EXPERIMENTAL)

Menachem Shay

My main interest is Raman scattering from magnetic excitation in high temperature superconductors. These measurements can probe the strength of the magnetic interaction between neighboring unit cells and allow an investigation of the mechanism that sets the value of the transition temperature to the superconducting state. Other fields of interest include optical properties of topological insulators and HTSC thin film fabrication and preparation.

Keywords: HTSC, Raman scattering, isotope effect

QUANTUM CONTROL

Shimshon Kallush

Quantum Control (QC) is dedicated to driving objectives into a given goal in the microscopic world, which is governed by quantum mechanics. Our research interests within this area range from fundamental research to theoretically and experimentally applicative aspects. We deal with basic questions of the applicability of QC, such as the sensitivity of a given control solution on the various parameters of the system. In our applicative research, we explore numerical methods for computing numerically exact quantum dynamics under general conditions to serve as a tool for understanding and predicting the ability to control quantum systems. We also collaborate closely with the experimental group of Prof. Phillip Gould at the University of Connecticut in seeking ways to apply quantum control methods to create ultra-cold (micro Kelvin) molecules with the aid of light pulses that fit the typical dynamics of these species, i.e., in nanosecond time scales. In addition, we collaborate with Dr. Sharly Fleischer at Tel Aviv University in the field of controlling the rotational motion of molecules under intense fields in the optical and THz regimes.

Keywords: Quantum mechanics, coherent control and controlability, ultracold physics, numerical propagation of dynamical systems, alignment and orientation of molecular rotors

ATTOSECOND SCIENCE

Avner Fleischer

Attosecond Science is the field of research that studies the ultrafast evolution of electrons in atoms, molecules and solids, on their natural attosecond timescale. Example processes, which occur on the attosecond time scale, are electron tunneling from atoms/molecules exposed to strong, infra-red laser fields, electron recollision [elastic or inelastic; the latter forms the phenomena of high harmonic generation (HHG)] induced by the same strong laser field; and electron rearrangement [or electron vacancy (hole) dynamics], which usually accompanies electron tunneling and/or recollision. By analyzing the emitted HHG radiation, or the momentum of the resulting fragments (electrons, ions), an instantaneous "picture" of the evolving quantum system could be retrievd. Numerical schemes (mainly solvers of the time dependent Schrodinger equation) are developd to increase our understanding of this complex dynamics. The research is done in cooperation with the group of Prof. Oren Cohen from the Technion.

Keywords: Attosecond science, extreme nonlinear optics, high harmonic generation, ultrafast evolution and imaging of electronic orbitals, ion and electron momentum imaging, quantum mechanics, numerical propagation of the Schrodinger equation.

STELLAR ASTROPHYSICS

Nathan Netzer

I study radiative transfer in stellar atmospheres and circumstellar envelopes. In stellar interiors, the radiation field is isotropic; in the outer layers of stars, where the optical depth is very low, the radiation field is collimated radially outwards. In both cases, the solution of the equation of radiative transfer is simple. In the transition zone, the solution is more complicated. The problem is important in order to solve the equations of motions governing the dynamics of stellar outflows. The problem thus far is solved for cases where the outflow rate is constant. Currently, the problem of variable outflow rate is being solved.

Keywords: Circumstellar envelopes, stellar atmospheres, radiative transfer

SUPERCONDUCTIVITY (THEORETICAL)

Jorge Berger

This research focuses on the geometric effects on mesoscopic superconducting samples, mainly rings, by means of the Ginzburg-Landau model and its generalizations. Special attention is devoted to thermal fluctuations, which are studied by means of appropriate Langevin functions.

Keywords: SQUID, superconducting rings, Ginzburg-Landau, Kramer Watts-Tobin, Langevin

LIGHT-MATTER STRONG COUPLING

Atef Shalabney, Said Mahajna, Ofer Ayal and **Michal Neumann**

When electromagnetic radiation is confined in tiny regions, the interactive nature of the radiation with matter becomes of great interest from both the fundamental point of view and for many optical engineering applications. This radiation confinement, usually accompanied by an extraordinary enhancement of the electric field intensity, accounts for many interesting effects such as surface enhanced Raman scattering (SERS), enhanced optical transmission, enhanced absorption and emission of light. It also enables high-resolution microscopy and imaging. These effects, however, are the outcomes of a weak light-matter interaction where the properties of the material do not change.

In the strong coupling regime, on the other hand, a resonant optical field can also couple to the transition dipole moment of a material oscillating with a given frequency and give rise to two new hybrid-light-matter states that are separated by the vacuum Rabi frequency. This regime is typically achieved by placing the material in the confined electromagnetic field of an optical cavity or a surface plasmon mode that is resonant with a given material transition.

In this research, we study the interactive nature of light in confined regions with matter. In the weak coupling regime, we exploit the enhanced electromagnetic field to boost optical phenomena for bio-sensing, disease diagnoses, and molecular detection. In the strong coupling

regime, we investigate the modification in the materials' properties due to the formation of the new hybrid states.

Keywords: Light-matter strong interaction, surface plasmon polaritons, bio-sensing, molecular detection, enhanced spectroscopy, enhanced Raman scattering

REFEREED PAPERS

G. Amelino-Camelia, D. Guetta and **T. Piran**, Possible relevance of quantum spacetime for neutrino-telescope data analyses. *Astrophysical Journal, 806*, 269, 2015.

J. Berger, Thermal fluctuations in 1D superconducting samples. *Physica Scripta T, 165*, 014022, 2015.

J. Berger, Flux-induced Nernst effect in a superconducting loop. *Superconductor Science and Technology*, *28*, 065008, 2015.

J. Berger, Influence of the boundary conditions on the current flow pattern along a superconducting wire. *Physical Review B*, *92*, 064513, 2015.

J. L. Carini, S. Kallush, **P. L. Gould** and **R. Kosloff**, Enhancement of ultracold molecule formation by local control in the nanosecond regime. *New Journal of Physics, 17*, 025008, 2015.

J. L. Carini, **S. Kallush**, **R. Kosloff** and **P. L. Gould**, Enhancement of ultracold molecule formation using shaped nanosecond frequency chirps. *Physical Review Letters, 115*, 173003, 2015.

T. Diskin, O. Kfir, A. Fleischer and **O. Cohen**, Phase modulation in polarization beating quasi phase matching of high harmonic generation. *Physical Review A*, *92*, 033807, 2015.

D. S. Ellis, Y.-B. Huang, P. Olalde-Velasco, M. Dantz, J. Pelliciari, G. Drachuck, R. Ofer, G. Bazalitsky, J. Berger, **T. Schmitt** and **A. Keren**, Correlation of the superconducting critical temperature with spin and orbital excitations in $(Ca_xLa_{1-x})(Ba_{1.75-x}La_{0.25+x})Cu_3O_y$ as measured by resonant inelastic x-ray scattering. *Physical Review B, 92*, 104507, 2015.

J. George, A. Shalabney, J. A. Hutchison, C. Genet and **T. W. Ebbesen**, Liquid-phase vibrational strong coupling. *Journal Physical Chemistry Letters, 6*, 1027-1031, 2015.

D. Guetta, Neutrinos from gamma ray bursts in the IceCube and ARA era. *Journal of High Energy Astrophysics*, 7, 90, 2015.

S. Kallush and **S. Fleicsher**, Orientation dynamics of asymmetric rotors using random phase wave functions. *Physical Review A, 91*, 063420, 2015.

O. Kfir, P. Grychtol, E. Turgut, R. Knut, D. Zusin, D. Popmintchev, T. Popmintchev, H. Nembach, J. M. Shaw, A. Fleischer, **H. Kapteyn, M. Murnane** and **O. Cohen**, Generation of phase-matched circularly-polarized extreme ultraviolet high harmonics for magnetic circular dichroism spectroscopy. *Nature Photonics, 9*, 99, 2015.

C. A. Mancuso, D. D. Hickstein, P. Grychtol, R. Knut, O. Kfir, X.-M. Tong, F. Dollar, D. Zusin, M. Gopalakrishnan, C. Gentry, E. Turgut, J. L. Ellis, M.-C. Chen, A. Fleischer, O. Cohen, H. C. Kapteyn and **M. M. Murnan**e, Strong field ionization with two-color circularly polarized laser fields. *Physical Review A, 91*, 031402(R), 2015.

A. Shalabney, J. George, J. A. Hutchison, G. Pupillo, C. Genet and **T. W. Ebbesen**, Coherent coupling of molecular resonators with a micro-cavity mode. *Nature Communications, 6*, 5981, 2015.

A. Shalabney, J. George, H. Hiura, J. A. Hutchison, C. Genet, P. Hellwig and **T. W. Ebbesen**, Enhanced Raman scattering from vibro-polariton hybrid states. *Angewandte Chemie International Edition, 54*, 7971-7975, 2015.

P. Sidorenko, O. Kfir, Y. Shechtman, A. Fleischer, **Y. C. Eldar, M.** Segev and **O. Cohen,** Sparsity-based super-resolved coherent diffraction imaging of one-dimensional objects. *Nature Communications, 6*, 8209, 2015.

G. Castignani, D. Guetta, **E. Pian, L. Amati, S. Puccetti** and **S. Dichiara,** Testing the delay of MeV-GeV emission with respect to soft-gamma rays in Fermi-LAT GRBs. *Astronomy & Astrophysics*, *565*, 9, 2014.

A. Fleischer, **O. Kfir, T. Diskin, P. Sidorenko** and **O. Cohen,** Bright high-order harmonics with controlled polarization. *Optics and Photonics News Special Issue: Optics in 2014*, *25*, 56, 2014.

A. Fleischer, **O. Kfir, T. Diskin, P. Sidorenko** and **O. Cohen,** Spin angular momentum and tunable polarization in high-harmonic generation. *Nature Photonics, 8*, 543, 2014.

see News & Views by **M. Ivanov and **E. Pisanty**, *Nature Photonics, 8*, 501, 2014.

S. Kallush and **J. Berger**, Qualitative modifications and new dynamic phases in the phase diagram of one-dimensional superconducting wires driven with electric currents. *Physical Review B*, *89*, 214509, 2014.

S. Kallush and **J. Berger**, Qualitative modifications and new dynamic phases in the phase diagram of one-dimensional superconducting wires driven with electric currents. *Physical Review B*, *89*, 214509, 2014.

S. Kallush, **M. Khasin** and **R. Kosloff**, Quantum control with noisy fields: Computational complexity vs. sensitivity to noise. *New Journal of Physics*, *16*, 015008, 2014.

S. Mahajne, D. Guetta, S. Lulinsky, S. Krylov and **Y. Linzon**, Liquid mass sensing using resonating microplates under harsh drop and spray condition. *Physics Research International,* 2014, Article ID 320324.

F. Tavecchio, G. Ghisellini and **D. Guetta**, Structured jets in BL lac objects: Efficient PeV neutrino factories? *Astrophysical Journal Letters, 793*, L18, 2014.

D. Wulferding, M. Shay, **G. Drachuck, R. Ofer, G. Bazalitsky, Z. Salman, P. Lemmens** and **A. Keren,** Relation between cuprate superconductivity and magnetism: A Raman study of $(CaLa)_1(BaLa)_2Cu_3O_y$. *Physical Review B*, *90*, 104511, 2014.

L. Yacobi, D. Guetta and **E. Behar,** Constraints on the hadronic content of gamma ray bursts. *Astrophysical Journal, 793*, 48, 2014.

Ando et al. Multi-messenger astronomy with gravitational waves. *Reviews of Modern Physics, 85*, 1401, 2013.

S. Asban, M. Shay, **M. Naamneh, T. Kirzhner,** and **A. Keren,** "Strong- vrsus weak-coupling paradigms for cuprate superconductivity. *Physical Review B, 88*, 060502(R), 2013.

P. Baerwald and **D. Guetta,** "Estimation of the neutrino flux and resulting constraints on hadronic emission models for Cyg X-3 using AGILE data. *Astrophysical Journal, 773*, 159B, 2013.

J. Berger, Characterization of the spontaneous symmetry breaking due to quenching of a one-dimensional superconducting loop. *Journal of Physics: Condensed Matter, 25,* 465702, 2013.

J. L. Carini, J. A. Pechkis, C. E. Rogers III, P. L. Gould, S. Kallush and **R. Kosloff,** Production of ultracold molecules with chirped nanosecond pulses: Evidence for coherent effects. *Physical Review A, 87*, 011401(R), 2013.

G. Drachuck, M. Shay, **G. Bazalitsky, R. Ofer, Z. Salman, A. Amato, C. Niedermayer, D. Wulferding, P. Lemmens** and **A. Keren,** New perspectives for cuprate research: $(Ca_xLa_{1-x})(Ba_{1.75-x}La_{0.25+x})Cu_3O_y$ Single Crystals". *Journal of Superconductivity and Novel Magnetism*, *25*, 2331, 2012.

E. Raz, Challenges and creative thinking in a problem appeared in the International Physics Olympiad. *Tehuda, 31(2), 14-22, 2013 (in Hebrew).*

BOOKS AND CHAPTERS IN BOOKS

A. Shalabney, Propagating surface plasmon polaritons. Sabine Szunerits and Rabah Boukherroub (Eds.), *Introduction to Plasmonics: Advances and Applications*, pp. 1-34. Pan Stanford: CRC Press, 2015. ISBN 9814613134, 9789814613132.

J. Berger, *Lecture notes in mechanics*. Jerusalem, Israel: Magnes Press, 2014.

REFEREED CONFERENCE PROCEEDINGS

S. Kallush, Orientation of non-linear molecules in room temperature using random phase wave functions. *QUAINT 5 Meeting*, Swansea, Wales, UK, 2015).

S. Kallush, Orientation of non-linear molecules in room temperature using random phase wave functions. *DAMOP*, Columbus, OH, USA, 2015.

A. Shalabney, Molecular vibrational strong coupling. *SPP7 Conference*, Jerusalem, Israel, 2015.

A. Fleischer, Bright high-order harmonics with fully controlled polarization by wave-mixing pumps with controlled spins. *HILAS Conference (High Intensity Lasers and High-Field Phenomena)*, Berlin, Germany, 2014.

Y. Linzon, S. Mahajne, D. Guetta, S. Lulinsky and S. Krylov, Electro-optically based liquid mass sensor using resonating micro-plate under harsh drop and spray condition. *International Conference on Optical MEMS and Nanophotonics (OMN)*, 125-126, 2014.

S. Mahajna and **Y. Linzon**, Liquid mass sensing with resonant micro-plate under harsh drop and spray condition. *Photonic Networks and Devices*, JT3A. 36.

S. Srivastava, A. Shalabney, **I. Khalaila, C. Gruner, B. Rauschenbach** and **I. Abdulhalim,** Highly sensitive SERS based nano-sculptured thin film biosensor for the detection of vitellogenin: An endocrine disruption biomarker. *Nanophotonic and Plasmonic Biosensors II (SeM3C)*, Barcelona, Spain, 2014.

N. Netzer, Interaction of dust and radiation: Putting A starts into the context. *Moscow State University* 2013**.**

INVITED TALKS

A. Fleischer, High-Order Harmonics with Fully Tunable Polarization by attosecond Synchronization of Electron Recollisions. *FRISNO13 Conference (French-Israeli Symposium on Non-linear and Quantum Optics)*, Aussois, France, 2015.

A. Fleischer, Towards attoChemistry: Imaging orbitals on their natural timescale. *80th Annual Meeting of the ICS (Israel Chemical Society)*, Tel Aviv, Israel, 2015.

A. Shalabney, Light-matter strong coupling and potential for chemistry and biology. *Eengineering Faculty, Bar- Ilan University*, Ramat Gan, Israel, 2015.

A. Shalabney, Light-matter strong coupling and potential for chemistry and biology. *Department of Electrical Engineering, Tel Aviv University*, Tel Aviv, Israel, 2015.

A. Shalabney, Light-matter strong coupling and potential for chemistry and biology. *Physical Chemistry Department, Weizmann Institute*, Rehovot, Israel, 2015.

A. Fleischer, Spin angular momentum and tunable polarization in high-harmonic generation. *Annual General Assembly of COST Action MP1203 (Advanced X-ray Spatial and Temporal Metrology)*, Dubrovnik, Croatia, 2014.

A. Fleischer, High-harmonic generation with fully controlled polarization: Examination of the role of spin angular momentum in extreme non-linear optics. *CHILI Conference (Conference on High Intensity Laser and attosecond science in Israel)*, Tel Aviv, Israel, 2013.

S. Kallush, Controllability and noise in large quantum systems. Seminar. *Holon Institute of Technology*, Israel 2014.

S. Kallush, Controllability and noise in large quantum systems. Seminar. *Tel Aviv University*, Israel, 2014.

S. Kallush, Formal control methods for ultra-cold molecule formation in the nanosecond regime. *QUAINT 3 Meeting*, Sandbjerk, Denmark, 2014.

D. Guetta, Quantum gravity phenomenology with neutrinos and high energy photons. *Loops 2013, Perimeter Institute for Theoretical Physics*, Waterloo, ON, Canada, 2013.

D. Guetta, Neutrino processes and gravitational wave emission: Theory. VESF School, OAR, lectures, Rome, Italy, 2013.

D. Guetta, High energy neutrinos from astrophysical sources. ANTARES collaboration, Bologna, Italy**,** 2013.

S. Kallush, Ultracold molecule formation by nanosecond-timescale frequency-chirped pulses. Seminar. University of Kassel, Germany, 2013.

Department of Software Engineering & Information Systems

Prof. Zeev Volkovich, Ph.D.,
Head of the Department

RESEARCH AREAS

ANALYSIS OF BIG CELLULAR DATA

Katerina Korenblat, Zeev Volkovich, Thomas Couronn (Orange Labs - France Telecom R&D) and **Valery Kirzner** (University of Haifa)

The research deals with mining and categorization of big sparse data describing consumers' cellular activity. Methods drawn from the bioinformatics area combined with novel clustering algorithm make it possible to reveal new users' behavior patterns.

Keywords: Big cellular data, compositional spectra, clustering of big data

APPLICATION OF KNOWLEDGE ENGINEERING, MODEL-DRIVEN SYSTEMS AND SOFTWARE ENGINEERING

Zeev Barzily, Mati Golani and **Avi Soffer**

The engineering discipline of knowledge engineering involves integrating knowledge into computer systems to solve complex problems that normally require a high level of human expertise. This integration is accomplished by building, maintaining and developing knowledge-based systems. Knowledge engineering has a great deal in common with software engineering and is related to many computer science domains, such as artificial intelligence, database systems, data mining, expert systems, decision support systems and management information systems. Model-driven engineering (MDE) is a software development methodology that focuses on creating models or abstractions, related to particular domain concepts. It is meant to increase

productivity by maximizing compatibility between systems, simplifying system development and maintenance, and promoting communication between individuals and teams working on the system.

Keywords: Knowledge engineering, model-driven engineering

BIOINFORMATICS

Katerina Korenblat, Zeev Volkovich and **Alex Bolshoy** (University of Haifa)

Research in the field of bioinformatics is focused in two main directions. The first concerns classifying organisms using properties of DNA sequences. The second deals with feature selection in the microarray data arrangement. In particular, the problem of active gene selection in leukemia diagnoses is considered.

Keywords: Genome classification, microarray analysis, features selection

COMBINATORIAL PROPERTY TESTING

Orly Yahalom

Property testing involves the relaxation of decision problems where we wish to decide with high probability whether the input has a given property or is "far" from having it. Interestingly, many properties can be effectively tested by querying only a small fraction of the input. The research is concerned with testing properties of combinatorial objects such as vertex colorings or edge orientations of graphs. We are interested in efficient property testers as well as in the lower bounds of query complexity in testing given problems.

Keywords: Property testing, sublinear algorithms, graph algorithms, randomized algorithms, massively parameterized

COMPILER OPTIMIZATIONS

Esti Stein and **Yosi Ben-Asher** (University of Haifa)

New hardware architectures (e.g., VLIW, FPGA, PIPELINE etc.) require new code optimizations for parallelizing the compiled code. This research involves developing algorithms for efficiently exploiting the parallel components of new architectures.

Keywords: Parallel architectures, FPGA, VLIW, parallelized code, compiler optimizations

COMPUTER SIMULATIONS OF SOCIAL INTERACTIONS

Alex Frid

One of the most interesting implications of game theory is the notion that human behavior can be usefully analyzed mathematically. Our research focuses on simulation and prediction of the human decision-making process in group conflict environments by developing strategies that will simulate human actions in various conflict situations.

Keywords: Decision making, iterative PD game simulations, computer simulations

DATABASE THEORY

Elena Ravve

Database theory encapsulates a broad range of topics related to the study and research of the theoretical realm of databases and database management systems.
Theoretical aspects of data management include, among other areas, the foundations of query languages, computational complexity and expressive power of queries, finite model theory, database design theory, dependency theory, foundations of concurrency control and database recovery, deductive databases, temporal and spatial databases, real time databases, managing uncertain data and probabilistic databases, and web data.
Keywords: Database, query languages, dendency theory

DATA MINING, TEXT MINING

Renata Avros, Zeev Barzily, Mati Golani, Katerina Korenblat, Elena Ravve, Avi Soffer, Dvora Toledano-Kitai, Zeev Volkovich, Orly Yahalom and **G.-W. Weber** (Institute of Applied Mathematics, Middle East Technical University, Turkey)

Data mining deals with understanding and interpretation of data as usually presented in large datasets. The main research topic in this area is the cluster validation problem. Resting upon modern statistical and computational tools, several new cluster stability criteria have been offered together with applications for text mining problems such as authorship recognition and themes selection.

Keywords: Clustering, feature selection, cluster validation, unsupervised learning

DIGITAL SIGNAL PROCESSING, AUDIO PROCESSING

Alex Frid and **Yizhar Lavner** (Tel-Hai Academic College)

The research field of Digital Signal Processing (DSP) focuses on the computational processing of discrete signals. With advances in processing power and the constant growth of information needing to be stored, this field has gained importance in almost every aspect of everyday life (ranging from communication systems to data compression to medical applications). Our

research focuses mainly on voice analysis, audio signal enhancement, event spotting and classification in speech and music.

Keywords: DSP, signal processing, phonetic classification, audio analysis, audio processing

FORMAL SOFTWARE AND HARDWARE VERIFICATION

Katerina Korenblat, Sergey Mazin, Elena Ravve and **Zeev Volkovich**

Formal methods are a particular kind of mathematically-based techniques for specification, development and verification of software and hardware systems. The use of formal methods for software and hardware design is motivated by the expectation that as in other engineering disciplines, appropriate mathematical analysis can contribute to the reliability and robustness of a design. Formal methods provide fully automated mathematical proofs of correctness. The high cost of using formal methods, however, means that they are usually only used in the development of high-integrity systems, where safety or security is of utmost importance.

Keywords: Program verification, formal methods in software engineering, program logics, BDD, temporal logics, Kripke model

GENERALIZED CONVOLUTION THEORY

Renata Avros, Dvora Toledano-Kitai and **Zeev Volkovich**

Generalized convolution theory is a notable area of modern probability theory. A new analytical approach in this field has been offered by Volkovich. One of the most well-known realizations of this construction is named the Volkovich Convolution. Recent research studies are focused on the search for new analytical tools that will provide a solution for the convolution embedding problem.

Keywords: Generalized convolution, general integral transforms, stochastic modeling

GRAPH POLYNOMIALS

Elena Ravve and **Johann. A. Makowsky** (Technion – Israel Institute of Technology)

f graph parameters (also called numeric graph invariants) are functions from the class of all finite graphs *G* to some numeric domain that is a commutative ring with 0 and 1, usually the integers Z, the rational numbers Q or the reals R. Graph properties are a special case where the value is 0 or 1. Graph polynomials are *p* functions from *G* into a polynomial ring. Graph polynomials are a way to encode infinitely many graph parameters.

Keywords: Generating function, roots, partition function

INCREMENTAL AND EFFECTIVE COMPUTATION

Elena Ravve

Incremental computation is a feature such that whenever a piece of data changes, it attempts to save time by only recomputing the output that "depends on" the changed data.

Keywords: (Strongly) distributed systems, decomposition, propagagtion

INFORMATION THEORY AND CODING THEORY

Binyamin Mounits

Research in this area of information and coding theory is concerned with finding upper bounds for the maximal cardinality of codes of a given block length with respect to the minimum hamming distance over finite fields. We search for bounds for the minimum average distance for subsets in metric association schemes. In addition, we seek to develop construction methods for constant weight codes and algebraic geometry codes with improved parameters.

Keywords: Information theory, coding theory, bounds on codes, association schemes

INTELLIGENT TESTING AND ANALYSIS OF SOFTWARE SYSTEMS

Katerina Korenblat, Avi Soffer, Dvora Toledano-Kitai, Elena Ravve and **Zeev Volkovich**

Software testing makes it possible to achieve a measure of software quality. The recent growth in the complexity of software systems confronts developers with much greater challenges in ensuring proper system behavior. This field of research, which is of interest to both academic and industrial communities, involves the development of automated techniques for detecting and correcting software errors in complex software systems.

Although the ultimate goal of testing is to find software faults, additional measures are taken to correct the faults. Since tests of complex systems must be executed many times and generate a large amount of data, the application of data mining for this purpose will focus in particular on finding information that will make it possible to reproduce an error and find its root cause. One approach to fault root-cause analysis involves applying and adjusting categorization algorithms in the field of testing. Such an algorithm, for example, makes it possible to analyze the structure of successful tests and detect the differences between these successes and a given failed test. For this purpose, attribute-oriented induction in data mining should be explored, as well as other methods for data classification.

Keywords: Software testing, debug, software fault detection, analysis and correction, data mining, categorization algorithms

LARGE GRAPH CLUSTERING

Yaniv Altshuler, Zakharia Frenkel, Katerina Korenblat, Nissan Levtov and **Zeev Volkovich**

This research is concerned with development of efficient algorithmic solutions for optimization problems involving large-scale graphs that represent interactions between entities. We deal mainly with methods for organizing and clustering biological and social networks.

Keywords: Graph clustering, PPI networks, social networks

NOVICE APPROACHES TO SOLVING ALGORITHMIC PROBLEMS ON STRINGS

Orna Muller, **Ayelet Butman** (Holon Institute of Technology) and **Bruria Haberman** (Davidson Institute of Science Education at the Weizmann Institute)

This study is a part of an ongoing research project concerned with various aspects of problem solving in the context of computer science and programming. It strives to explore and analyze the problem-solving (PS) behavior of novices such as PS approaches, abstraction skills and methods of dealing with complexity and cognitive load. The algorithmic problems examined involve string manipulation and pattern matching. SOLO (Structure of Observed Learning Outcomes) taxonomy is used to analyze students' solutions.

Keywords: Problem solving, instructional design, string manipulation, SOLO taxonomy

OPERATION AND CONTROL OF MANUFACTURING SYSTEMS BY AGENTS WITH LOCAL INTELIGENCE

Miri Weiss-Cohen, **Michael Mitnovitsky** (Technion – Israel Institute of Technology) and **Moshe Shpitalni** (Technion – Israel Institute of Technology)

Our focus is on development and research of agent-based adaptive control systems that handle resource allocation in a dynamic flow shop with a big variety of uncertainty issues. We study a flexible flow shop problem considering dynamic events such as stochastic job arrivals, uncertain processing times, unexpected machine breakdowns and the possibility of processing flexibility. To achieve this goal, a new agent-based adaptive control system has been developed at the factory level along with advanced decision-making strategies that provide responsive factories with adaptation and reconfiguration capabilities, and advanced complementary scheduling abilities. The aim is to enable operational flexibility and increase productivity as well as to offer strategic advantages such as analyzing factory development options by using simulation. The feasibility of the proposed system has been shown by simulation under various experimental settings such as shop utilization level, due date tightness, breakdown level etc.

Keywords: Multi-agent system, flexible flowshop, dynamic scheduling, task sequencing, resources allocation

PHARMACOKINETIC MODELING OF DRUGS

Mati Golani and **Idit Golani**

The blood–brain barrier (BBB) presents a real challenge to the pharmaceutical industry. The BBB is a very effective screener of different kinds of bacterial infections. Unfortunately, it also prevents many drugs from penetrating it. An assessment model is required to improve drug development. An effective assessment model can drastically reduce development times by eliminating drugs with low success rates. It can also save considerable amounts of money by directing clinical trials to focus only on drugs that are more likely to succeed.

Keywords: Bioinformatics, neural nets, feature selection

PROJECT-BASED SERVICE-LEARNING

Orna Muller, Orit Braun Benyamin and **Noga Shalit**

Project-Based Service-Learning involves the development of a product for the benefit of an individual or an organization. This engineering-education study follows ORT Braude College's flagship project in which students develop assistive devices for people with special needs. It uses Grounded Theory Methodology in order to reveal graduates' perceptions and the long-term impact of the project.

Keywords :Engineering education ,project-based service learning ,people with special needs, assistive devices ,grounded theory

RECONFIGURABLE ARCHITECTURES AND COMPILER OPTIMIZATIONS

Esti Stein and **Yosi Ben-Asher** (University of Haifa)

Reconfiguration is the ability of architecture or a component to change its function and/or its structure according to the computation. The recent developments in VLSI technology created a new class of computer architecture that takes advantage of application-level parallelism. Reconfigurable Meshes (RM) are used as a theoretical model for massive parallel computation. The new light multi-core architectures will make the theoretical model real within the foreseeable future. The great advantage of such networks (RM) is the high execution speed of algorithms, partly due to the fact that the connections between the cores can be changed dynamically during the algorithm.

Optimization is the process of transforming a piece of code to make it more efficient (either in terms of time or space) without changing its output or generating side effects. The only difference visible to the code's user should be that it runs faster and/or consumes less memory. Optimization aims to improve, not perfect, the result.

The research focuses mainly on developing algorithms for existing reconfigurable architectures

such as FPGA and for future architecture models such as reconfigurable mesh. These algorithms are mostly used within the compiler as optimizations to accelerate run-time.

Keywords: Reconfigurable mesh, FPGA, compiler optimizations

REMOTE NEUROLOGICAL DISEASE DIAGNOSIS

Alex Frid and Shmuel Raz (Rowland Institute, Harvard University)

Remote diagnostics is the act of diagnosing a given symptom, issue or problem from a distance. Instead of the subject being co-located with the person or system doing the diagnostics, in remote diagnostics the subjects can be separated by physical distance. This, in turn, may reduce the consumption of in-hospital human power and other resources. The aim of the current study is to develop computational tools (using image processing, 3D modeling and feature extraction and selection methods) for identifying and measuring progression levels of various neurological diseases such as Parkinson's disease (PD) and evaluating the effectiveness of treatments and drugs.

Keywords: Parkinson's disease (PD), remote diagnosis, 3D modeling

REQUIREMENTS ENGINEERING

Avi Soffer

Requirements engineering (RE) is the branch of software engineering that focuses on the processes of elicitation, organization, representation, specification, modeling, linking, validation, tracing, and management of requirements in any software development and maintenance effort. RE research involves developing and applying technologies and practices from software and systems engineering, project management, and model-based development fields.

Keywords: Requirements engineering, software engineering, model-based development

SCAFFOLDING OF STRING-MATCHING PROBLEM-SOLVING IN CS1

Orna Muller and **Ayelet Butman** (Holon Institute of Technology)

This study is a part of ongoing research and development focusing on instructional design. We are exploring students' problem-solving (PS) approaches, with the aspiration of introducing an instructional scaffolding that promotes students' PS skills. We are currently focusing on string matching problems introduced in an introduction to computer science course.

Keywords :Problem solving ,instructional scaffolding ,string matching

SCULPTURED SURFACE COVERAGE OF 3D SOLIDS USING GENETIC ALGORITHMS

Miri Weiss-Cohen

NURBS surfaces are used for 3D solids, given that the solid is arranged on a flat surface. This research seeks to optimize the residue of non-covered surfaces and the gap between the covering 3D solid and the sculptured surface. This optimization involves using genetic algorithms for defining the optimal mesh for the surface.

Keywords: NURBS surfaces, surface coverage

SEQUENCE BIOLOGY

Zakharia Frenkel, Zeev Volkovich, Zeev Barzily, Avi Soffer and Edward Trifonov (University of Haifa)

The research includes development of algorithms for computational analysis of DNA and protein sequences. The main goals of this analysis are sequence annotation and evolutionary studies. The algorithms concern different fields such as text clustering algorithms or algorithms for network analysis.

Keywords: DNA and protein sequence annotation, text mining, network analysis

SOFTWARE ENGINEERING, SYSTEM SPECIFICATION AND DESIGN METHODOLOGIES

Zeev Barzily, Mati Golani and **Avi Soffer**

Software engineering is concerned with the study and application of a systematic, disciplined and quantifiable approach to the development, operation and maintenance of software. It involves using both computer science and engineering principles and practices towards improved handling of requirements, specification, design, implementation and verification of software systems. It also incorporates database design and optimization, as well as architecture design methodologies. Software engineering research involves developing and applying technologies and practices from computer science, project management, engineering application domains, interface design, digital asset management and other such fields.

Keywords: Software engineering, requirements engineering, specification, design

TRAJECTORY PLANNING FOR MULTI-AGENT SYSTEMS

Miri Weiss-Cohen, Gideon Avigad and **Erella Eisenstadt**

This research focuses on planning free collision trajectories for cooperating multi-agent systems by using different evolutionary approaches. The research involves the optimization of agents' trajectories, which are subjected to reciprocal constraints, such as distance between the agents

less than a predefined distance; maintaining the distance between the agents greater than a predefined distance (avoiding collisions); always allowing eye contact between the agents; or always having one agent occupy each sub-workspace. The research includes the development of new tools for combining B-splines, NURBS curves and genetic algorithms.

Keywords: Multi-agents, path planning, evolutionary algorithms

WIRELESS SENSOR NETWORKS

Zeev Volkovich and **Peter Soreanu**

Research related to wireless sensor networks is a hot topic, due to technological advances that allow for new and complex applications. Performance improvements, mostly energy, efficiency and security related, are of utmost importance in this field. The main research topic concentrates on energy-efficient routing, sensing, data fusion and communication algorithms. Other related active research topics are efficient clustering, mobile sensors, and security and tracking issues.

Keywords: WSN, wireless sensor networks, energy efficient, sensing models, sensing coverage, WSN jamming, malicious node, object tracking

REFEREED PAPERS

D. Berend, E. Korach and **O. Yahalom**, Anticoloring of the Rook's graph. *Discrete Applied Mathematics*, *188*, 1-15, 2015.

R. Avros, D. Toledano-Kitai, Z. Frenkel and **Z. Volkovich**, An iterative projective clustering method. *Procedia Computer Science*, *60*, 122-130, 2015.

E. Ravve, Incremental computations over strongly distributed databases. *Concurrency and Computation: Practice and Experience*, *28*, 3061-3076, 2015.

J. Batista Q. Zuliani, **M. Weiss Cohen**, **L. S. Batista** and **F. G. Guimarães**, Multi-objective topology optimization with ant colony optimization and genetic algorithms. *Computer-Aided Design and Application*, *12*(6), 674-682, 2015.

M. Weiss Cohen, A. Frid, **M. Malin** and **V. Ladijenski,** Generating 3D CAD art from human gestures using a Kinect depth sensor. *Computer-Aided Design and Application*, *12*(5), 1-9, 2015.

R. Nibhani, A. Soffer, A. Mu'alem, Z. Volkovich and **Z. Frenkel,** Application of a K-ladder connectivity algorithm for clustering of protein evolutionary network. *International Journal of Modeling and Optimization, 4*(5), 367-374, 2014.

N. Levtov, S. Amberkar, Z. Frenkel, L. Kaderali and **Z. Volkovich,** Detecting non-uniform clusters in large-scale interaction graphs. *Journal of Computational Biology*, *21*(2), 173-83, 2014.

J. Makowsky, E. Ravve and **N. Blanchard,** On the location of roots of graph polynomials. *European Journal of Combinatorics, 41*, 1-19, 2014**.**

E. Ravve, Z. Volkovich and **G.-W. Weber**, Effective optimization with weighted automata on decomposable trees, optimization. *Journal of Mathematical Programming and Operations Research, Special Issue on Recent Advances in Continuous Optimization on the Occasion of the 25th European Conference on Operational Research (EURO XXV 2012)*, *63*(1), 109-127, 2014.

J. Makowsky and **E. Ravve**, On the location of roots of graph polynomials. *Electronic Notes in Discrete Mathematics, 43*, 201-206, 2013.

R. Avros, A. Soffer, Z. Volkovich and **O. Yahalom**, An approach to model selection in spectral clustering with application to the writing style determination problem. *Knowledge Engineering and Knowledge Management, Communications in Computer and Information Science*, 415, 19-36, 2013.

I. Fischer, A. Frid, S. J. Goerg, S. A. Levin, D. I. Rubenstein and **R. Selten**, Fusing enacted and expected mimicry generates a winning strategy that promotes the evolution of cooperation. *Proceedings of the National Academy of Science* (*PNAS*), 110(25), 10229-10233. 10.1073/pnas.1308221110, 2013.

Z. Frenkel, S. Amberkar, L. Kaderali and **Z. Volkovich**, Repeated bisections approach for local clustering of PPINs. *Journal of Modern Mathematics Frontier* (*JMMF*), *2*(1), 19-24, 2013.

Z. Frenkel and **E. Trifonov,** Text segmentation approach reveals simple repeat "fossils" in genomic sequences. *Albany 2013 Conversation 18*, *Journal of Biomolecular Structure and Dynamics*, *31*(S1), 1–139**,** 2013.

S. Kogan, Z. Frenkel, O. Kupervasser and **Z. Volkovich**, Hierarchy of protein loop-lock structure (HoPLLS): A new server for decomposition of protein structure into a set of closed loops. *Journal of Computational Molecular Bioscience* (*CMB*), *3*, 1-8, 2013.

D. Toledano-Kitai, R. Avros, Z. Volkovich, G.-W. Weber and **O. Yahalom**, A binomial noised model for cluster validation. *Journal of Intelligent and Fuzzy Systems*, *24*, 417–427, 2013.

Z. Volkovich, D. Toledano-Kitai and **G. W. Weber**, Self-learning k-means clustering: A global optimization approach. *Journal of Global Optimization* (*JOGO*), *56*(2), 219-232, 2013.

ACCEPTED FOR PUBLICATION

D. Toledano-Kitai, R. Avros and **Z. Volkovich,** A model selection method for heavy-tailed clustering. *A book devoted to ASMDA2015 Conference*, 2015.

R. Avros, A. Soffer, D. Toledano-Kitai and **Z. Volkovich,** Cluster model selection using minimum cost spanning trees. *A dook devoted to the ASMDA2013 Conference*, 2014.

BOOKS AND CHAPTERS IN BOOKS

O. Granichin, Z. Volkovich and **D. Toledano-Kitai**, Randomized algorithms in automatic control and data mining. Intelligent Systems Reference Library 67, Springer, 2014.

REFEREED CONFERENCE PROCEEDINGS

R. Avros, D. Toledano-Kitai, Z. Frenkel and **Z. Volkovich,** An iterative projective clustering method. *Knowledge-Based and Intelligent Information & Engineering Systems 19th Annual Conference*, *KES-2015*, Singapore, 7-9 September, 2015.

M. Mintovsky, M. Weiss Cohen and **M. Shpitalni,** An optimization model for manufacturing systems in an uncertain environment. *ASME/Design for Manufacturing and the Life Cycle (DFMLC)*, Boston, MA, USA, 2-5 August, 2015.

O. Muller, N. Shalit and **O. Braun-Benyamin,** Students of engineering on behalf of people with disabilities: Evaluating the impact of an institution's flagship project. *45th ASEE/IEEE Frontiers in Education (FIE) Conference*, El Paso, Texas. 1844-1848, October, 2015.

E. Ravve, Z. Volkovich, and **G.-W. Weber,** Automatic definition of optimal default parameters of models. *Proceedings of the 17th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing*, pp. 251-256, 2015.

E. Ravve, Z. Volkovich and **G.-W. Weber,** Incremental reasoning on strongly distributed multi-agent aystems. *Proceedings of the 17th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing*, pp. 415-422, 2015.

E. Ravve, Z. Volkovich and **G.-W. Weber,** A uniform approach to incremental automated reasoning on strongly distributed structures. *EasyChair Proceedings in Computing*, volume 36, pp. 229-251, 2015.

D. Toledano-Kitai, R. Avros and **Z. Volkovich,** A model selection method for heavy-tailed clustering. *Proceedings of the 16th conference of ASMDA international society (ASMDA2015)*, Piraeus, Greece, 30 June- 4 July, 2015.

M. Weiss Cohen, **J. A. Kennedy, A. Pirmisashvili** and **G. Orlikov,** An automatic system for analyzing phantom images to determine the reliability of pet/spect cameras. *ASME/BIOMED*, Boston, MA, USA, 2-5 August, 2015.

M. Weiss Cohen, **M. Mintovsky** and **M. Shpitalni,** Manufacturing systems controlled by agents. *International Congress of Industrial and Applied Mathematics (ICIAM)*, Beijing, China, 10-14 Aug, 2015. Invited Talk.

M. Weiss Cohen, A. Dahan and **I. Caspi,** Software system for container vessel stowage planning using a genetic algorithm. *ACM Genetic and Evolutionary Computation Conference (GECCO'15)*, Madrid, Spain, 11-15 July, 2015.

M. Weiss Cohen, **M. Aga** and **T. Weinberger,** Genetic algorithm software system for analog circuit design. *CIRP Design*, Haifa, Israel, Procedia CIRP, 36, pp. 17-22, 2-5 March, 2015. doi:10.1016/j.procir.2015.01.033

E. Ravve, Views and updates over distributed databases. *16th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC)*, pp. 341-348, 2014.

E. Ravve, Analyzing WMSOL definable properties on sum-like weighted labeled trees. *16th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC),* pp. 375-382, 2014.

E. Ravve and **Z. Volkovich**, Four scenarios of effective computations on sum-like graphs. *Proceedings of the 9th International Multi-Conference on Computing in the Global Information Technology,* 1-8, 2014.

D. Toledano-Kitai and **Z. Volkovich,** On stable states of the GMM clustering. *Proceedings of the 3rd SMTDA2014 (Stochastic Modelling Techniques and Data Analysis) International Conference (SMTDA 2014)*, Lisbon, Portugal, 11-14 June, 2014.

M. Weiss Cohen, A. Frid, M. Malin and V. Ladijenski, 3D CAD art from human gestures. *CAD Conferences*, Hong Kong, 22-25 June, 2014.

R. Avros, A. Soffer, D. Toledano-Kitai and Z. Volkovich, Cluster model selection using minimum cost spanning trees, stochastic modeling techniques and data analysis. *International Conference* **(***SMTDA 2013***), Mataró (Barcelona) Spain, 25-28 June, 2013.**

R. Avros, Z. Barzily and **Z. Volkovich**, Self-tuning clustering using the information geometry technique. *IADIS European Conference, Data Mining 2013*, Prague, Czech Republic, July, 2013.

E. Ravve and **Z. Volkovich**, A systematic approach to computations on decomposable graphs. *15th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC)*, pp. 398-405, 2013.

M. Weiss-Cohen, M. Aga and **T. Weinberg,** A decision support system for analog circuit design using genetic algorithms. *CAD & Applications*, Bergamo, Italy, 17-20 June, 2013.

M. Mintovsky, **M. Weiss Cohen** and **M. Shpitalni,** Operation and control of manufacturing systems by agents with local intelligence. *BRICS-CCI*, Recife, Brazil, 9-12 September, 2013,

J. B. Q. Zuliani, L. S. Batista, F. G. Guimarães, **M. Weiss Cohen**, **M. L. David** and **A. Lowther,** Topology optimization with ant colony systems in applied electromagnetics. *COMPUMAG*, Budapest, Hungary, 30 June-4 July, 2013.

ORAL PRESENTATION AT INTERNATIONAL CONFERENCES

R. Avros, D. Toledano-Kitai, Z. Frenkel and **Z. Volkovich,** An iterative projective clustering method. *Knowledge-Based and Intelligent Information & Engineering Systems 19th Annual Conference, KES-2015*, Singapore, September, 2015.

D. Toledano-Kitai, R. Avros and Z. Volkovich, A model selection method for heavy-tailed clustering. *16th Conference of ASMDA International Society* (*ASMDA2015*), Piraeus, Greece, 30 June–4 July, 2015.

Z, Frenkel, Ancient repeats in protein coding sequences. *6th MMN (Molecular Mechanism of Neurodegeneration) Meeting*, Milan, Italy, 28-30 May, 2015.

E. Ravve, Z. Volkovich and G.-W. Weber, Automatic definition of optimal default parameters of models. *17th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing*, 2015.

E. Ravve, Z. Volkovich and G.-W. Weber, Incremental reasoning on strongly distributed multi-agent systems. *17th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing*, 2015.

E. Ravve, Z. Volkovich and G.-W. Weber, A uniform approach to incremental automated reasoning on strongly distributed structures. *Global Conference on Artificial Intelligence*, 2015.

E. Ravve, Views and updates over distributed databases. *16th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC)*, 2014.

E. Ravve and Z. Volkovich, Four scenarios of effective computations on sum-like graphs. *9th International Multi-Conference on Computing in the Global Information Technology*, 2014.

D. Toledano-Kitai and Z. Volkovich, On stable states of the GMM clustering. *3rd SMTDA2014 (Stochastic Modelling Techniques and Data Analysis) International Conference (SMTDA 2014)*, Lisbon, Portugal, 11-14 June, 2014.

R. Avros, A. Soffer**, D. Toledano-Kitai** and Z. Volkovich**,** Cluster model selection using minimum cost spanning trees, stochastic modelling techniques and data analysis. *International Conference* (*SMTDA 2013*), Mataró (Barcelona) Spain, 25-28 June, 2013.

Z. Frenkel and E. Trifonov, Text segmentation approach reveals simple repeat "fossils" in genomic sequences. *Albany 2013 Conversation 18*, State University of New York, Albany, NY, USA. 11-15 June, 2013.

A. Frid and I. Fischer, Evolutionary computer simulations of SERS. *International Society of Political Psychology* (*ISPP*) *Annual Meeting*, Herzliya, Israel, 8-11 July, 2013.

A. Frid, H. Hazan and L. Manevitz, Temporal pattern recognition via temporal networks of temporal neurons. *12th Bar-Ilan Symposium on the Foundations of Artificial Intelligence* (*BISFAI*), Bar-Ilan University, Ramat Gan, Israel, 19-21 June, 2013.

A. Frid, H. Hazan, and L. Manevitz, Towards classifying human phonemes without encodings via spatiotemporal liquid state machines. *17th International Conference on Cognitive and Neural Systems* (*ICCNS*), Boston University, Boston, MA, USA, 4-7 June, 2013.

E. Ravve and Z. Volkovich, A systematic approach to computations on decomposable graphs. Views and updates over distributed databases. *15th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC)*, 2013.

E. Ravve, BCNF decomposition via attribute splitting. *Dagstuhl Seminar "Automated Reasoning on Conceptual Schemas"*, Germany, 19-24 May, 2013**.**

T. Vaserman, T. Shraga, **A. Frid,** H. Hel-Or, S. Raz and I. Schlesinger, Automatic quantitative assessment of hand movements and finger taps in Parkinson's disease. *12th Bar-Ilan Symposium on the Foundations of Artificial Intelligence (BISFAI)*, Bar-Ilan University, Ramat Gan, Israel, 19-21 June, 2013.

NON REFEREED CONFERENCE PROCEEDINGS AND ABSTRACTS

E. Ravve, A new method for automatic generation of DRC and LVS runsets. Technical Conference of ChipEx2013, Tel-Aviv, May, 2013.

GRANTS

Z. Volkovich, D. Toledano-Kitai and **A. Soffer**, Intelligent testing and analysis of concurrent software – Czech-Israeli cooperative scientific research. Israel Ministry of Science and Technology, 2013-2014.

Z. Volkovich, PATHOSYS – New algorithms for host pathogen systems biology. FP7-HEALTH-2010, Single-stage grant, partner in EU Consortium, 2010-2014.

JOURNAL REFEREE

E. Ravve

RONMat
Numerical Algebra, Control and Optimization
Proceedings of GraphSM-2015
Proceedings of ICCGI-2015

M. Weiss-Cohen

CAD – Computer Aided Design
CAD & Applications
Computers and Graphics
Journal of Intelligent and Robotic Systems

O. Yahalom

Proceedings of Approximation, Randomization, and Combinatorial Optimization Algorithms and Techniques, APPROX-RANDOM
LANCS series

Z. Volkovich

Central European Journal of Operation Research
Communications in Statistic
Computers and Mathematics with Applications
Discrete Applied Mathematics
European Journal of Operational Research
Journal of Pattern Recognition Research
Journal of Statistical Planning and Inference and SP letters (JSPI)
IEEE Transactions on Systems, Man and Cybernetics
Lithuanian Mathematical Journal
Mathematical Problems in Engineering
Meteorology and Atmospheric Physics
Optimization

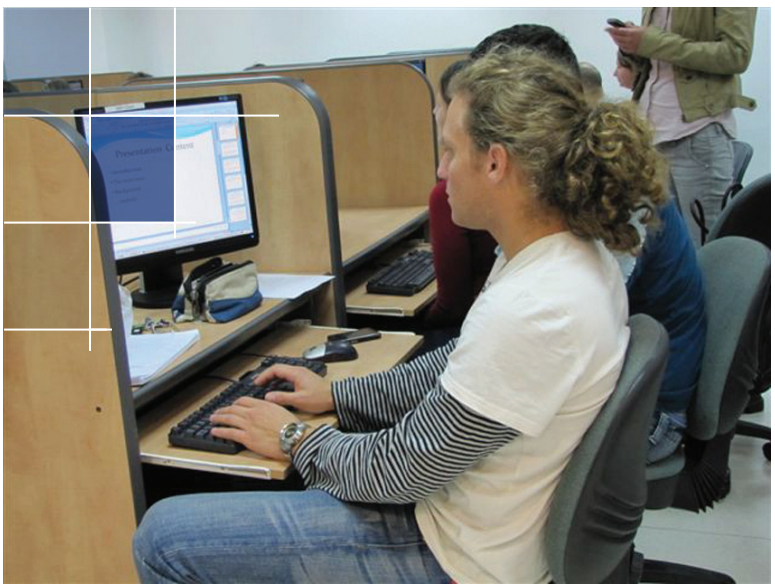
Optimization Letters
Pattern Recognition
Pattern Recognition Letters
Statistics and Probability Letters
Proceedings of "Text Mining 2012", 10th Workshop on Text Mining, 12th SIAM International Conference on Data Mining
Proceedings of "Text Mining 2011", 9th Workshop on Text Mining, 11th SIAM International Conference on Data Mining

INVITED TALKS

Z. Frenkel, Ancient repeats in protein coding sequences. *6th MMN (Molecular Mechanism of Neurodegeneration) Mee*, Milan, Italy, 28-30 May, 2015.

E. Ravve, BCNF decomposition via attribute splitting. *Dagstuhl Seminar "Automated Reasoning on Conceptual Schemas"*, Germany, 19-24 May, 2013**.**

E. Ravve On the location of roots of graph polynomials. *Workshop on Algebraic Combinatorics, Ben-Gurion University*, 27 February, 2013.



Department of Teaching and General Studies

Dr. Elena Trotskovsky, Ph.D,
Head of the Department

RESEARCH AREAS

"THE WINNING COUPLE TREASURES" PROGRAM FOR STRESS REDUCTION AND ENHANCING RESILIENCY

Miri Shacham, Jehudit Spanglet (Ben-Gurion University) and **Meirav Tal** (David Yelin College)

The study explores a new program for children, "The Winning Couple's Treasures", focused on body–mind coping skills for stress reduction and resiliency enhancing.
The research aim is to examine how the use of the treasures' self-help tools helps children in coping with traumatic and ongoing war situations. The research tools were questionnaires and in-depth interviews with teachers and children in the south of Israel.

Keywords: The winning couple's treasures, coping resources, self-help tools, the stream model

PERCEPTIONS OF FORMER ENGINEERS AS MATHEMATICS TEACHERS

Ira Raveh and **Orna Muller**

Following the shortage of mathematics teachers having an adequate academic background and qualifications for teaching mathematics, the Department of Teaching at ORT Braude College, and other academic institutions, designed and now operate programs that train engineers to become mathematics teachers in schools.

This study aims at characterizing engineers' perceptions of mathematics and mathematics teaching, and examines whether and how, theses perceptions change and develop following the training programs and experience of in-service teaching mathematics at schools.

Keywords: Teachers' beliefs, mathematics teacher education, teaching as a second career

ENGINEERS AS SECOND-CAREER TEACHERS

Yael Furman Shaharabani, **Miri Shacham** and **Orna Muller**

While research concerning career changers is prevalent, very little is known about engineers who switch to teaching. The study aims to explore the possible contribution of education and previous career in engineering to teaching as a second career. A deeper understanding of the unique skills and qualities engineers bring with them to school may help better utilize these skills for the promotion of Science and Technology Education.

Keywords: Career changers, teaching as a second career, engineering education

FROM ENGINEERING TO MATHEMATICS TEACHING: PERCEPTIONS OF MATHEMATICS, MATHEMATICS TEACHING AND MATHEMATICAL UNDERSTANDING

Ira Raveh and **Yael Furman Shaharabani**

Nowadays, more and more engineers are changing their careers and becoming mathematics teachers. This group of career changers will most definitely contribute to molding future mathematics education. Quite possibly, previous experience in different fields of engineering has left a mark on the engineers, influencing their teaching perceptions and attitudes towards mathematics and mathematics education. It is well known that the perceptions and attitudes of teachers are somewhat reflected in their teaching. Hence, it is important to study the perceptions and attitudes of this group of future mathematics teachers. The study looks into engineers as career changers and their initial perceptions as teachers' of mathematics, mathematics teaching and mathematical understanding.

Keywords: Career changers, engineers as teachers, mathematics teaching, mathematical understanding

PRE-SERVICE ENGINEERING AND MATHEMATICS TEACHERS' PERCEPTIONS AND DEVELOPMENT OF "TEACHING FOR UNDERSTANDING"

Yael Furman Shaharabani

Understanding is a main goal of teaching and learning; yet, it is not achieved easily. The "teaching for understanding" approach presents a way to focus teachers' attention on their students' understanding when planning their instruction together with paying attention to students'

performance. This research explores the development of engineering and mathematics pre-service teachers' perceptions of students' understanding, and their ability to plan understanding-based instruction.

Keywords: Professional development, teaching for understanding, pre-service

MATHEMATICAL AND ENGINEERING UNDERSTANDING: THE PERSPECTIVE OF ENGINEERING STUDENTS

Ira Raveh, **Elena Trotskovsky** and **Nissim Sabag**

The subject of mathematics has always existed in the very core of engineering education. Engineering students take many courses in mathematics during their qualification for an undergraduate degree in engineering. This study looks into how undergraduate engineering students at ORT Braude College perceive engineering and mathematical understanding—the similarities and differences between them.

Keywords: Understanding, mathematical thinking, engineering thinking

TEACHERS' KNOWLEDGE OF THE INTERCONNECTIONS BETWEEN THE STANDARD ALGORITHMS OF FOUR ARITHMETIC OPERATIONS AND THEIR UNDERLYING MATHEMATICAL PRINCIPLES

Ira Raveh, **Boris Koichu** (Technion – Israel Institute of Technology), **Orit Zaslavsky** (Technion – Israel Institute of Technology and New York University) and **Irit Peled** (University of Haifa)

This study aims to identify the components of schoolteachers' mathematical knowledge regarding the teaching of standard algorithms and examines a particular way of promoting their understanding of the mathematical principles underlying the algorithms. The methodological contribution of the study consists of a method for developing operational criteria for identifying and promoting various components of the teachers' knowledge. On the practical level, the findings help in formulating recommendations for improving the ways of teaching the subject, either in professional development programs for teachers or in school settings.

Keywords: Standard algorithms of the four arithmetic operations, mathematical knowledge for teaching.

THEORY PRACTICE GAP: TEACHERS-AS-LEARNERS QUESTIONS

Yael Furman-Shaharabani and **Anat Yarden** (Weizmann Institute of Science)

The gap between practice and theory is a well-known barrier to education improvement. There is an ongoing need to understand teachers' thinking and find new ways to connect practice and theory meaningfully. The research aim is to explore the ways in which in-service teachers link

practice and theory using teachers-as-learners' questions asked in the context of two academic courses directed at mediating practice and theory. Twenty-two experienced biology high school teachers participated in the research.

Keywords: Theory-practice gap, science teachers, in-service, teachers' questions

ENGINEERING STUDENTS' MISUNDERSTANDINGS AND MISCONCEPTIONS IN ENGINEERING THINKING

Elena Trotskovsky, **Nissim Sabag**, **Orit Hazzan** (Technion – Israel Institute of Technology) and **Shlomo Waks** (Technion – Israel Institute of Technology)

Students' misunderstandings and misconceptions frequently impede learning processes and frustrate students' best efforts. Researchers have investigated these phenomena broadly, but little is known about how they relate to engineering thinking. Many researchers associate learners' misunderstandings and misconceptions with certain disciplines. We claim that some learning difficulties are common to several engineering disciplines. The aim of the study is to answer the following question: What engineering-thinking misunderstandings and misconceptions do students typically have in the areas of electronics, and mechanical and software engineering? The research presents three levels of students' engineering-thinking misunderstandings, according to their generality. The first level relates to misunderstandings of specific content learned in a concrete engineering discipline; the second level deals with more general students' problems in interpreting and integrating knowledge, which they typically make in several engineering disciplines; and the third level describes misunderstandings characteristic of students in most engineering disciplines.

Keywords: Engineering thinking, misconceptions, misunderstanding

REFLECTION IN ENGINEERING THINKING

Nissim Sabag, **Elena Trotskovsky** and **Shlomo Waks** (Technion – Israel Institute of Technology)

The longitudinal research comprises two studies: a three-year three-stage study on technology project-based learning (TPBL) and a three-year two-stage study on engineering thinking (ET). Both studies used qualitative tools such as interviews, active observations, and document analysis. The data analysis indicates that reflection is not generated on its own; it must be fostered. Reflection takes one of three forms: as a reaction to an irregularity or error made when working on the system design; conducted in groups, which is inherent to the design process in industry; and from intuition that something may not be quite right, even though preliminary results seem to be correct.

Keywords: reflection, critical thinking, cognitive development, metacognition, project design, project-based learning

INTEGRATION OF MASSIVE ONLINE OPEN COURSES (MOOC) IN GENERAL STUDIES

Nissim Sabag, **David Pundak** (Kinneret Academic College) and **Elena Trotskovsky**

Higher education institutions face conflicting challenges; they must equip students with up-to-date knowledge in fields in which knowledge is constantly being revised and they also need to guide students in learning how to examine reality through broad-based observation and consider different scientific disciplines. They operate within different restrictions such as learning program boundaries, budgetary constrictions, lack of accessibility to experts in different areas, and a limited range of courses that can be offered to students. To cope with these constraints, ORT Braude College opened an experimental program. As part of this program, students were allowed to study massive online courses (MOOC), supervised by teachers from the College, and were eligible for accreditation if they completed the courses successfully. The study examines the background to the College's decision, the students' registration and supervision process, detailing students' challenges and achievements in the MOOC program.

Keywords: MOOC, accreditation, evaluation, online learning, higher education

ENGINEERING STUDENTS' MISCONCEPTIONS OF ACCURACY AND ESTIMATIONS

Elena Trotskovsky and **Nissim Sabag**

Calculating accuracy, evaluation and estimation are an inevitable part of engineering practice, and they are integral to any problem solving method in the process of engineering design and product development. Usually, these methods are not taught in the engineering curriculum in a methodical way. The underlying assumption is that the students can develop their evaluation skills on-site, at their jobs, after they finish their studies. The pedagogical experience of the authors shows that engineering students have various difficulties in accuracy, evaluation and estimation in problem solving, laboratory experiments and design projects. The study seeks to uncover the typical problems involving accuracy, evaluation and estimation and find pedagogical ways to overcoming the problems.

With the aim of helping students understand the real spirit of engineering, educators should emphasize engineering principles. Including accuracy, evaluation and estimation issues into the engineering curriculum can be an effective tool for attaining this goal.

Keywords: Accuracy, evaluation, estimation, engineering education

USING TECHNOLOGY TO PROMOTE TEACHING

Samuel Kosolapov, Evgeny Gershikov and **Nissim Sabag**

The technological and didactic aspects of using Instant Feedback System (IFS) are examined and developed to improve teaching and learning, as well to improve the IFS.

Keywords: Instant feedback system, active learning, promote teaching and learning

LOGISTICS AND TIME EFFICIENCY OF MICRO EXAMS

Samuel Kosolapov and **Nissim Sabag** are also involved in research of different methods to improve logistics of academic tests using cameras, scanners and cloud computing.

Keywords: Cloud computing, image processing, active learning

FACTORS OF ENGINEERING STUDENTS' EXCELLENCE

Nissim Sabag

This research tries to answer the big question: "Why do the exellent students succeed in their academic studies?" The research is conducted in collaboration with the Technion.

Keywords: Engineering education, excellent students, higher education

MATHEMATICAL AND ENGINEERING UNDERSTANDING: THE PERSPECTIVE OF ENGINEERING STUDENTS

Elena Trotskovsky and **Nissim Sabag**

The subject of mathematics has always stood at the very core of engineering education. Engineering students take many courses in mathematics during their qualification for an undergraduate degree in engineering. This study looks into how BSc engineering students at ORT Braude **C**ollege perceive engineering and mathematical understanding**,** examining the similarities and the differences between them.

Keywords: Understanding, mathematical thinking, engineering thinking

MATCHING LEARNING STYLES TO INSTRUCTIONAL STRATEGIES

Nissim Sabag and **Elena Trotskovsky**

This research investigates the correlations of students' academic achievements with the distance between students' learning styles (LS) and their teachers' instructional strategies (IS).

Keywords: Engineering education, learning styles, matching learning styles to instructional strategies

REFEREED PAPERS

M. Shacham, "Suddenly–war": Intervention program for enhancing teachers' and children's resilience following war. *Review of Research and Social Intervention, 48*, 50-59, 2015.

E. Trotskovsky, **N. Sabag**, **S. Waks**, and **O.Hazzan**, Students' achievements in solving problems using models and their misunderstanding of models in electronics. *IEEE Transactions on Education*, *58*(2), 2015. DOI: 10.1109/TE.2014.2331918.

E. Trotskovsky, **N. Sabag**, and **S. Waks**, One output function: Students' misconception in digital electronics. *Journal of Research in Science and Technological Education*, *1*, 2015. DOI: 10.1080/02635143.2014.983468.

D. Pundak, **N. Sabag** and **E. Trotskovsky**, Accreditation of MOOC courses. *European Journal of Open, Distance and e-Learning*, *17*(2), 116–128, 2014.

I. Raveh, and **B. Koichu**, Mathematical knowledge for teaching of the elementary algorithms of the four basic arithmetic operations. *Mispar Hazak 2000, 25*, 51-61, 2014. (In Hebrew.)

E. Trotskovsky and **N. Sabag**, How do engineering students misunderstand the concept of accuracy? – Work in progress. *World Transactions on Engineering and Technology Education, 12*(4), 2014, 715-719.

E. Trotskovsky and **N. Sabag,** Internship project – Design in industry vs. research in Academia – A case study. *Educational Alternatives*, *12*, 581-587, 2014. Published on line 4 September 2014.

D. Pundak, **M. Shacham**., & **O. Herskovits**, Integrating online assignment checking in introductory courses. *Journal of Information Technology Education: Research, 12,* 2013.

N. Sabag, **E. Trotskovsky**, and **S. Waks**, Engineering design projects as a reflection promoter. *European Journal of Engineering Education,* published on line 10 December 2013. DOI**:** 10.1080/03043797.2013.867312

E. Trotskovsky, **S. Waks**, **N. Sabag** and **O. Hazzan**, Students' misunderstandings and misconceptions in engineering thinking. *International Journal of Engineering Education, 29*(1) 107-118, 2013.

BOOKS AND CHAPTERS IN BOOKS

Y. Od-Cohen, and M. Shacham, Doctoral learning between cultures enhancing lifelong learning. In: E.A. Panitsides and J. Talbot, (Eds.), *Lifelong learning: Concepts, benefits and challenges.* New York: Nova Science Publishers. Accepted for publication November 2015.

M. Lahad, M. Shacham and **O.Ayalon** (Eds.), The "BASIC PH" model of coping and resiliency; theory, research and cross-cultural application. London: Jessica Kingsley Publishers, 2013.

M. Lahad, M. Shacham and **Y. Shacham**, How Jewish and Arab parents perceived their children's resiliency during the second Lebanon war. In: M. Lahad, M. Shacham and O. Ayalon (Eds), *The*

"BASIC PH" model of coping and resiliency; theory, research and cross-cultural application. London: Jessica Kingsley Publishers, 2013.

J. Spanglet, M. Tal-Margalit and **M. Shacham**, From trauma to resilience – Enhancing the STREAM model with embodied faith and spirituality. In: M. Lahad, M. Shacham and O. Ayalon (Eds.), *The "BASIC PH" model of coping and resiliency; theory, research and cross-cultural application.* London: Jessica Kingsley Publishers, 2013.

REFEREED CONFERENCE PROCEEDINGS

Y. Furman Shaharabani, Teaching for understanding: Pre-service engineering and mathematics teachers' perceptions and learning. *EDULEARN15 Proceedings: 7th International Conference on Education and New Learning Technologies*, Barcelona, Spain, July, 2015.

I. Raveh, **E. Trotskovsky** and **N. Sabag**, Mathematical vs. engineering understanding: Engineering students' perceptions. *International Conference on Engineering Education ICEE – 2015*. Zagreb, Croatia, July, 2015.

N. Sabag and **E. Trotskovsky**, Comparing characteristics of final projects: BSc students vs. practical engineering students – The supervisors' point of view. *ICEE 2015, International Conference on Engineering Education*, pp. 685-690, Zagreb, Croatia, 20-24 July, 2015.

E. Trotskovsky and **N. Sabag**, How electrical engineering students understand the accuracy concept concerning digitized signals. *ICEE 2015, International Conference on Engineering Education*, pp. 156 – 161 Zagreb, Croatia, 20-24 July, 2015.

O. Muller, **Y. Furman Shaharabani** and **M. Shacham**, Engineers as second-career teachers: The perceived contribution of engineering education and career to teaching. *Proceedings of the 43nd ASEE/IEEE Frontiers in Education (FIE) Conference,* pp. 2506-2510, Madrid, Spain, 2014.

N. Sabag and **E. Trotskovsky**, Matching instructional strategies to learning styles: Does it contribute to students' achievements?, *ICEE/ ICIT 2014, Joint International Conference on Engineering Education & International Conference on Information Technology*, pp. 134-142, Riga, Latvia, 2 June-6 June, 2014.

E. Trotskovsky and **N. Sabag**, Internship project – Design in industry vs. research in academia – A case study. *5th International Conference on Education, Research & Development,* Elenite, Bulgaria, 4 September-9 September 2014.

E. Trotskovsky and **N. Sabag**, Students' misconception of accuracy. *ICEE/ ICIT 2014, Joint International Conference on Engineering Education & International Conference on Information Technology*, pp. 148-154, Riga, Latvia, 2 June-6 June, 2014.

Y. Od-Cohen and **M. Shacham,** Doctoral learning communities and cross cultural learning. *1st International Conference "EDUCATION, REFLECTION, DEVELOPMENT" in UBB,* Cluj, Romania, June, 2013.

I. Raveh and **B. Koichu**, A reference framework for teaching the standard algorithms of the four basic arithmetic operations: From theoretical analysis to task design. *CERME8*, Turkey, 2013.

N. Sabag, **E. Trotskovsky** and **S. Waks**, Misconceptions in electronics design using simulation. *International Conference on Engineering Education and Research ICEER– 2013*, pp. 945-952. Marrakesh, Morocco, July, 2013.

N. Sabag and **E. Trotskovsky**, Using lab experiments in electric circuits to promote achievements in mathematics. *Global Engineering Education Conference (EDUCON), 2013 IEEE,* pp. 123-129. Berlin, 2013.

E. Trotskovsky, **N. Sabag**, **S. Waks** and **O. Hazzan**, Students' misunderstandings in project design activities in clectronics. *International Conference on Engineering Education and Research ICEER – 2013*, pp. 1016-1023. Marrakesh, Morocco, July 2013.

ORAL PRESENTATION AT INTERNATIONAL CONFERENCES

Y. Furman Shaharabani, Teaching for understanding: Pre-service engineering and mathematics teachers' perceptions and learning. *EDULEARN15: 7th International Conference on Education and New Learning Technologies*, Barcelona, Spain, July 2015.

I. Raveh, **E**. Trotskovsky and N. Sabag, Mathematical vs. engineering understanding: Engineering students' perceptions. *International Conference on Engineering Education ICEE – 2015*. Zagreb, Croatia, July, 2015

M. Shacham and Y. Od-Cohen, Intercultural learning: Doctoral learning between three cultures. *3rd International Conference "EDUCATION, REFLECTION, DEVELOPMENT" in UBB*, Cluj, Romania, 3-4 July, 2015.

J. Spanglet, M. Tal-Margalit and M. Shacham, The 'winning couple's treasures' program for children in Israel: Body–mind coping skills for stress reduction & enhancing resiliency. *36th Annual Conference of the Stress and Anxiety Research Society (STAR)*, Tel Aviv University, Israel, 30 June-2July, 2015.

E. Trotskovsky and N. Sabag, How electrical engineering students understand the accuracy concept concerning digitized signals. *ICEE 2015, International Conference on Engineering Education*, pp. 156-161, Zagreb, Croatia, 20-24 July, 2015.

Y. Furman-Shaharabani and A. Yarden, Concerns of experienced biology teachers. *10th European Researchers in Didactics of Biology (ERIDOB) Conference*, Haifa, Israel, July, 2014.

M. Shacham, Academic coaching program for enhancing students' learning. *2nd International Conference "EDUCATION, REFLECTION, DEVELOPMENT" in UBB*, Cluj, Romania, June, 2014.

M. Shacham and **Y. Od-Cohen** Academic workshops promoting international doctoral program. *2nd International Conference "EDUCATION, REFLECTION, DEVELOPMENT" in UBB, Cluj, Romania,* June, 2014.

E. Trotskovsky and N. Sabag, Internship project - Design in industry vs. research in academia – A case study. *5th International Conference on Education, Research & Development,* Elenite, Bulgaria, 4 September-9 September, 2014.

E. Trotskovsky and N. Sabag, Students' misconception of accuracy. *ICEE/ ICIT 2014, Joint International Conference on Engineering Education & International Conference on Information Technology*, pp. 148-154, Riga, Latvia, 2 June-6 June, 2014.

Y. Furman-Shaharabani, Teaming up: The contribution of team work to teachers' learning during teacher research. *6th International Conference on Teacher Education: Changing Reality through Education*, Tel Aviv, Israel, July, 2013.

Y. Od-Cohen and **M. Shacham**, Doctoral learning communities and cross cultural learning. *1st International Conference "EDUCATION, REFLECTION, DEVELOPMENT" in UBB,* Cluj, Romania, June, 2013.

I. Raveh and B. Koichu**,** A reference framework for teaching the standard algorithms of the four basic arithmetic operations: From theoretical analysis to task design. *CERME8*, Turkey, 2013.

E. Trotskovsky, N. Sabag, S. Waks and O. Hazzan, Students' misunderstandings in project design activities in electronics. *International Conference on Engineering Education and Research ICEER – 2013*, pp. 1016-1023. Marrakesh, Morocco, July, 2013.

NON REFEREED CONFERENCE PROCEEDINGS AND ABSTRACTS

I. Raveh, **E. Trotskovsky** and **N. Sabag**, Mathematical vs. engineering understanding: Engineering students' perceptions (work in progress). *11th ORT Braude College Interdisciplinary Research Conference*, Hagoshrim, Israel, 2015.

M. Shacham, **J. Spanglet** and **M. Tal-Margalit**, The 'winning couple's treasures' program for children in Israel: Stress reduction and enhancing resiliency. *11th ORT Braude College Interdisciplinary Research Conference*, Hagoshrim, Israel, 2015.

Y. Furman-Shaharabani, **M. Shacham** and **O. Muller**, Engineers as second-career teachers during their first year in school. *10th ORT Braude College Interdisciplinary Research Conference,* Nahariya, Israel, October, 2014.

I. Raveh and **O. Muller**, Transforming engineers into math teachers: Students' and graduates' perceptions of the program. *10th ORT Braude College Interdisciplinary Research Conference*, Nahariya, Israel, October, 2014.

I. Raveh, Mathematical knowledge for effective teaching and learning: The case of four algorithms. *9th ORT Braude College Interdisciplinary Research Conference*, Hagoshrim, Israel, 2013.

GRANTS

Y. Furman Shaharabani, **M. Shacham** and **O. Muller**,

Engineers as Second-Career Teachers: The Perceived Contribution of Engineering Education and Career to Teaching, the MOFET Institute (Research, Curriculum and Program Development for Teacher Educators), 2013.

JOURNAL REFEREE

Y. Furman-Shaharabani

Journal of Research in Science Teaching (Journal, Wiley)

O. Muller

Computer Science Education (Journal, Taylor & Francis)
Frontiers in Education (Conference)

M. Shacham

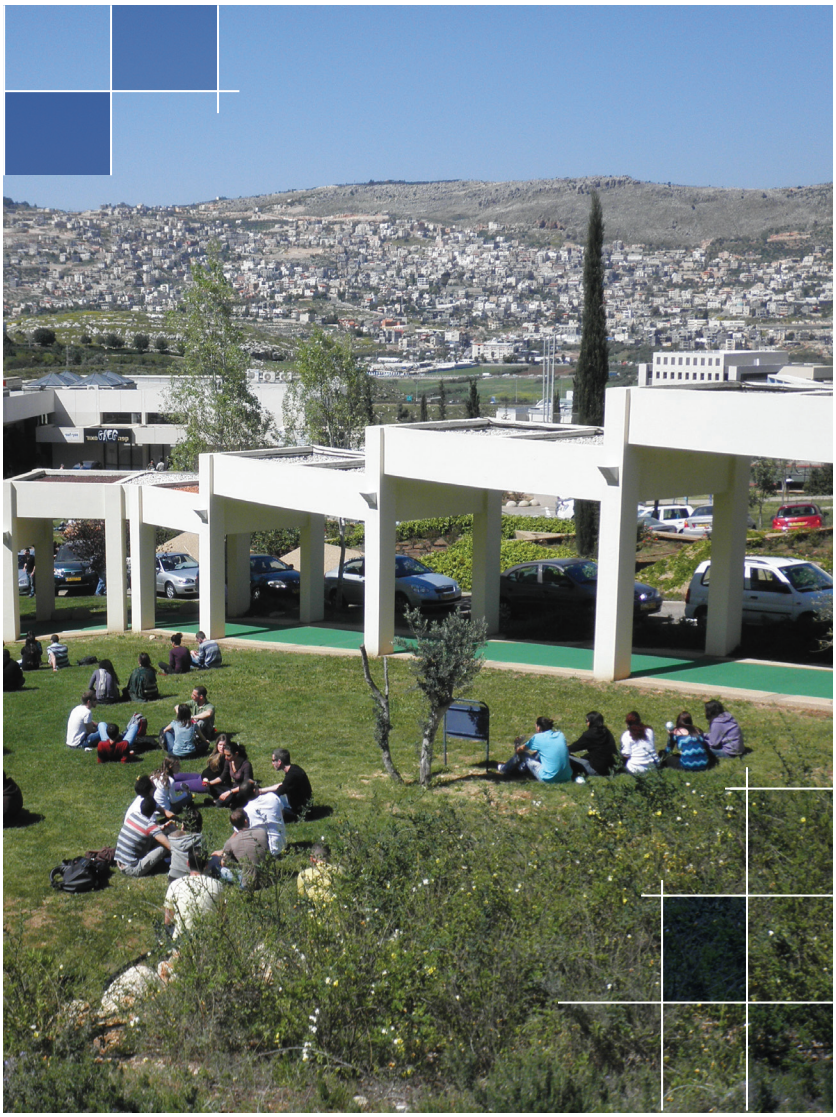
Innovations in Education and Teaching International (Journal, Routledge)

INVITED TALKS

Y. Furman Shaharabani, The contribution of team work to teachers learning during self-study". Efrata College. Jerusalem, Israel, February, 2014.

M. Shacham, Population evacuation in times of war. *11th Settlement Conference*, Chispin, Israel, December, 2014.

M. Shacham, The Basic PH model of coping and Resiliency. Encounter of coaches in the Ministry of Education's Program: *"Schools Leading Quality Pedagogy"*, Tel Aviv, Israel, January 2014.



Teaching and Learning Center

Dr. Dvora Toledano Kitai, Ph.D.,
Head of Teaching & Learning Center

RESEARCH AREAS

ATTITUDES OF FACE-TO-FACE E-LEARNING INSTRUCTORS TOWARD 'ACTIVE LEARNING'

David Pundak, Orit Herscovitz (Technion – Israel Institute of Technology)**, Miri Shacham** and **Rivka Weiser-Biton**

Instruction in higher education has developed significantly over the past two decades, influenced by two trends: promotion of active learning methods and integration of web technology in e-Learning. Many studies have found that active teaching improves students' success, involvement and thinking skills. Nevertheless, internationally, most instructors are still using traditional teaching methods. A research tool, the Active Instruction Tendency – (AIT) questionnaire, developed on the basis of active instructors' experience uncovered the transitions they have undergone. Following a review of the literature and examination of active instructors' attitudes, six key areas that may characterize the lecturer's tendency to adopt active learning were identified. Using the AIT questionnaire, we examined attitudes concerning active learning of 135 instructors in three Israeli higher education institutions and 56 European distance and e-learning instructors. Their attitudes were compared with the attitudes of active instructors who, for the past five years, had taught in active learning environments. In all six identified instruction areas, significant differences were found between attitudes of active instructors and other instructors. Identification of these differences expands the theoretical knowledge corpus concerning instructors' attitudes toward active learning, presenting a new tool to characterize these attitudes.

Keywords: Active learning, active instructors, e-learning, students' involvement, evaluation

EFFECTIVE STUDENT MENTORING

Sharon Tidhar, Miri Shacham, Dvora Toledano-Kitai and **David Pundak**

The Center for Teaching and Learning at ORT Braude College has developed a unique program called MALAT to promote academic achievements of students whose academic status is unsatisfactory at the end of first year.

As part of the "aid basket" offered to students, the Center offers personal mentoring in the various fields of study. The mentors are students who have excelled in engineering studies, been assessed and specially trained. The training course includes topics such as interpersonal communication, learning styles, and a variety of teaching and learning methods.

The TLC learning counselor supervises the mentors individually to enhance their in-service training and tracks their work. The training and supervision program are included in a longitudinal study.

The research aims are:

To examine the contribution of personal mentoring to students with regard to academic self-efficacy, learning habits and academic achievements

To examine the contribution of the training program and mentoring to personal mentors with regard to learning habits and academic self-efficacy.

Keywords: Student mentoring, Center for Teaching and Learning (TLC), academic self-efficacy, learning habits

EMPLOYING A MARKETING APPROACH TO CREATE A LEARNING ENVIRONMENT FOR ENGINEERING STUDENTS

David Pundak and **Arie Maharshak**

This research investigates the freshman engineering student's world, special needs and attitudes from a marketing viewpoint. It examines students' attitudes regarding textbook reading and use of Internet sites as a supportive environment for basic courses. 134 college engineering students and 94 university engineering students participated in research relating to reading habits before and during academic studies, preferred language for textbooks (English or Hebrew), reading skills and use of on-line learning materials. Findings indicated similar reading habits for college and university students, except for use of on-line learning materials and a significant correlation between pre-academic study reading habits and reading during academic studies. More than 90% of the students clearly prefer textbooks written in their mother tongue. The students rarely used textbooks to deepen understanding of course subjects, but thought they were very important for success in the courses. They used textbooks primarily for help in solving exercises. University students used on-line learning materials more often in comparison with the college students.

Keywords: Learning environment, marketing, mother tongue, online learning, reading

ENGINEERING STUDENTS - READING HABITS AND FRAGILE KNOWLEDGE

Orit Herscovitz (Technion)**, David Pundak** and **Miri Shacham**

The study deals with the perceptions of freshman engineering students regarding the importance of textbooks. Two disturbing results concerning the reading habits of engineering students emerged from previous studies: (a) Most students rarely derive assistance from the textbooks of basic courses, and (b) knowledge acquired in basic courses is "fragile" knowledge that quickly dissipates. Students, therefore, gain little knowledge from introductory courses intended to prepare them for advanced courses. To overcome this situation, a teaching method was designed that would guide students in deriving assistance from textbooks. The method gives credit in the final course grade for active reading. The research population comprised engineering students enrolled in a physics course taught using the reading embedded approach.

Keywords: Textbook, engineering students, reading embedded, fragile knowledge

ARE MOOCS APPROPRIATE FOR UNDERGRADUATE STUDENTS?

David Pundak, **Nissim Sabag** and **Elena Trotskovsky**

Higher education institutions face conflicting challenges; They must equip students with up-to-date knowledge in fields in which knowledge is constantly being revised, while also needing to guide students in learning how to examine reality through broad-based observation and consider different scientific disciplines. They operate under different restrictions such as learning program boundaries, budgetary constrictions, and lack of accessibility to experts in different areas, and a limited range of courses. To cope with these constrictions, Ort Braude College opened an experimental program. As part of this program, students were allowed to study massive online open courses (MOOC), supervised by teachers from the College, and were eligible for accreditation if they completed the courses successfully. Only 15 students out of the 600 students offered the program registered for these courses. Only seven were accepted for the program. This paper describes the background to the College's decision, the registration process and supervision of students, detailing students' challenges and achievements in the MOOC program. Students who completed the MOOC program reported that they enjoyed meaningful learning requiring serious efforts in comparison to the courses that the MOOC program replaced. Given this positive feedback by the students, it was decided to continue with the experiment.

Keywords: MOOC, accreditation, evaluation, online learning, higher education.

CONCEPTUAL FRAMEWORKS IN ASTRONOMY OF ENGINEERING STUDENTS

David Pundak

Students' approaches toward astronomy can be divided into four conceptual frames of references: (1) Mythical and pre-scientific – the order in the world is determined by gods and supernatural forces. (2) Geocentric – the Earth is the heaviest body in the universe and it lies at

the universe's center. (3) Heliocentric- Earth's sun is the heaviest body in the universe and it is located at the orbital center of all celestial bodies. (4) Sidereal – the stars are the fundamental component of the universe and our sun is only one small star among trillions and trillions of stars spreading out all over the universe. Each astronomical conceptual frame of reference offers a different interpretation of astronomical phenomena. The research aim was to evaluate the effects of an elective astronomy course on astronomical conceptual frames of reference held by engineering students. Research population: 51 students taking astronomy courses taught in the spring semester, 2015 in the Engineering School of Kinneret Academic College. Methodology: A conceptual framework in astronomy questionnaire from 1990* was adapted for the research. Eight new questions were added to the research questionnaire so that it contained 23 questions in total. The questionnaire allowed students to choose their answers according to their preferred frame of reference. The questionnaire was revalidated by four astronomy faculty. The tool was administered pre- and post- the elective astronomy course.

Keywords: Engineering education ,conceptual development ,epistemology ,astronomy

HOW TO RECOGNIZE STUDENTS' APPROACESH TOWARD WEB LEARNING?

David Pundak, Rivka Weiser-Biton and **Yehuda Peled** (Western Galilee College)

Background: In the education departments of academic colleges, students study online learning technologies including the consideration of their advantages and disadvantages. The students in these courses have different levels of familiarity with the Internet. This familiarity usually relates to acquisition of information and generally relies on social networks such as WhatsApp and Facebook, watching film clips on YouTube, exchanging instant messages, using electronic mail and searching for information on Google. Studies from recent years show a dramatic increase in use of the Internet for information gathering. Technology in Education courses expose students to new learning environments and different learning processes than those which they knew from school or those that they are used to employing in their daily lives. We examined the extent of the change in students' opinions concerning online learning as the result of a Technology in Education course. The research question was "To what extent was there a change in the attitudes of students taking a Technology in Education course, from the beginning to the end of the course as regards the following issues: (a) The information that the Internet can offer to a learner, (b) the learner's ability to process information and create new knowledge, (c) giving and receiving feedback for learning products in a direct manner through the Internet, and (d) planning of learning both as a learner and as a teacher."

Hereinafter the term "Technology in Education course" is used to relate to courses that exploit the use of the Internet to improve the learning environment

Keywords: Technology in education, social learning, peer feedback, online learning

FACE-TO-FACE VERSUS E-LEARNING

Orit Herscovitz (Technion), **David Pundak** and **Miri Shacham**

Instruction in institutions of higher education has developed significantly over the past two decades under the influence of two trends: promotion of active instruction methods and integration of web technology in e-Learning. Many studies testify to the success of active instruction methods in improving student involvement during courses and final examinations. Nevertheless, most instructors worldwide still use traditional teaching methods. A research tool was developed based on the experience of active instructors. The research examined the attitudes of 135 instructors in three Israeli higher education institutions and 56 European distance and elearning instructors concerning active instruction.

Keywords: eLearning, active instruction, traditional instruction

"FROM GOOD TO EXCELLENT"- COACHING FOR SUCCESS

Miri Shacham, Rivka Weiser-Biton (Department of Biotechnology Engineering)**, Dvora Toledano-Kitai** and **David Pundak**

The Teaching and Learning Center initiated a new coaching program called "From good to excellent" that has two goals. On the personal level, it aims to promote students' academic achievements and self-efficacy. On the college level, it aspires to enhance students' achievements and empower them with high levels of academic achievement. The students were assigned to the program in an assessment center managed by the psychologists of the TLC. The students participate in a group, being coached in dealing with personal and academic success and excellence and/or difficulties, their vision, goals, and work plans. They also participate in workshops focusing on applying to engineering jobs, stress management, effective presentation, and conflict management.
The current research focuses on students' perceptions regarding the contribution of the coaching program to their personal and academic development. In addition, the study aims to explore the impact, if any, of being a coach on the professional development of the College's lecturers.

Keywords: Coaching for success, personal and academic excellence

INTEGRATING ONLINE ASSIGNMENTS CHECKING IN INTRODUCTORY COURSES

David Pundak, Miri Shacham and **Orit Herscovitz (**Technion**)**

Web technology offers lecturers the option of checking students' assignments online. Several systems have evolved to deliver personal assignments to each student in a multi-participant course. These systems provide students with immediate feedback, allowing them to correct erroneous answers and referring them to relevant literary sources that can assist them with their assignments. These strategies influence the lecturers' teaching and their ability to respond to students' difficulties in real-time. The study examines student attitudes concerning the integration of the WebAssign (WA) Online Assignment Checker (OAC) in the teaching of academic courses. An on-line questionnaire

investigated attitudes of 75 engineering students taking introductory academic courses assisted by OAC. The questionnaire included the following six dimensions: involvement and interest, understanding the studied material, lecturers' consideration of students' difficulties, importance of the course, tutorial methods and dishonest assignment submission. Significant findings emerged for attitudes in three dimensions. The students think that OAC helps lecturers relate to their difficulties, contributes to their success in the course, and does not encourage cheating such as copying. No preference was found between submitting homework in hardcopy or online.

Keywords: Online assignment checker - OAC, student attitudes, understanding, involvement, dishonest learner behavior

PEER-LED TEAM LEARNING PROGRAM FOR SUPPORTING FIRST-YEAR STUDENTS'LEARNING

Orit Herscovitz (Technion)**, Orna Muller** and **Miri Shacham**

The Peer-Led Team Learning (PLTL) program at ORT Braude College promotes learning among first-year students. As part of the program, students lead workshops for developing self-learning in courses with high failure rates. The research focuses on two aspects: Perceptions and achievements of students who participate in the workshops, and peer leaders' gains. Findings reveal that the achievements of the workshops' students, in most of their courses, were significantly higher than those who did not participate in the workshops. The students that benefited the most from the workshops are those with higher academic capabilities. The peer leaders felt high satisfaction and believe they have gained self-confidence, and mentoring and communication skills for their future careers.

Keywords: Keywords: Peer-Led Team Learning (PLTL), peer leaders, active learning, first-year students, STEM introductory courses

PERSONAL-ACADEMIC COACHING AS A TOOL FOR PROMOTING STUDENTS' LEARNING

Miri Shacham and **Rivka Weiser-Biton** (Department of Biotechnology Engineering)

As a part of ORT Braude College's MALAT program, some students are personally coached by a trained lecturer. The main research goal is to explore the individual academic coaching process from the points of view of the student and coaches. We found that the students underwent a change and began taking full responsibility for making decisions concerning their own learning, thus promoting their success. The trained lecturers who served as coaches felt that they had acquired important tools for their professional development through the close exposure to different students and learning styles.

Keywords: Coaching, underachieving, academic status, self-regulation

STUDENT LOANS – STATED VERSUS PERCIEVED ATITTUDES

David Pundak and **Arie Maharshak**

The present research seeks to understand why Israeli engineering students would rather finance their education by working rather than by applying for readily available loans. Prospect theory and norm theory may offer some understanding of and insight into this behavior. According to prospect theory, taking a loan would be perceived by students as a large risk compared to their anticipated income upon graduation. Norm theory suggests that students will decide to work during their studies if they believe this is the accepted norm in their social circle.

Keywords: Student work, norm theory, prospect theory, engineering students

CONFERENCES, WORKSHOPS & SEMINARS

The 5th Conference on New Initiatives for Promoting Learning in Higher Education, The Center for Teaching and Learning, ORT Braude College, May, 2015

D. Toledano-Kitai, and **S. Tidhar**: "Internationalization of Engineering Curricula-OBC", International workshop of The Curriculum (IoC), Sapir College, 15-16 November, 2015.

D. Toledano-Kitai, **M. Shacham**, and **Y. Forman Shaharabani**: "Developing an international workshop: OBC Case Study: How to promote ownership of faculty?" ORT Braude College, 26-28 May 2014.

REFEREED PAPERS

O. Muller, O. Herscovitz and **M. Shacham**, Peer-led team learning in a college of engineering: First-year students' achievements and peer leaders' gains. *Innovations in Education and Teaching International*. Submitted for publication, November 2015.

D. Pundak, M. Shacham and **O. Herskovits,** Integrating online assignment checking in introductory courses. Journal of Information Technology Education: Research, *12*. 2013.

BOOKS AND CHAPTERS IN BOOKS

Editing textbook in Hebrew - David Pundak

K. Cummings, **P. Laws**, **R. Radish** and **P. Coony**, *Understanding physics – Wave and thermodynamics*. Magnes Press, Hebrew University, (in press),

REFEREED CONFERENCE PROCEEDINGS

R. Weiser-Biton, **M. Shacham** and **D. Pundak**, Active learning vs traditional learning in the view of lecturers and students. *Proceedings of the 16th Conference of the Applied Stochastic Models and Data Analysis International Society*, University of Piraeus, Greece, 30 June-4 July, 2015.

D. Pundak, O. Herskovits and **M. Shacham,** Integrating online assignment checking in introductory courses. *Proceedings of Informing Science & IT Education Conference (InSITE)*, Porto, Portugal, 1–6 July, 2013.

D. Pundak, M. Shacham and **O. Herskovits** Integrating online assignment checking in academic studies. *11th Meital Conference - "New Technologies and their Assessment in On-Line Teaching and Learning*. The Hebrew University, Jerusalem. June, 2013.

ORAL PRESENTATION AT INTERNATIONAL CONFERENCES

R. Weiser- Biton, M. Shacham and D. Pundak (2015). Active learning vs. traditional learning in the view of lecturers and students. *Proceedings of the 16th Conference of the Applied Stochastic Models and Data Analysis International Society.* University of Piraeus, Greece, 30 June-4 July, 2015.

M. Shacham, Personal-academic coaching program for enhancing students' learning. *2nd International Conference "EDUCATION, REFLECTION, DEVELOPMENT".* UBB, Cluj, Romania, June, 2014.

M. Shacham and D. Toledano-Kitai**,** Personal-academic coaching for first-year engineering students. *8th International Meeting. Victor Frankl Hochschule University College of Teacher Education*, Klagenfurt, Austria, November, 2014.

M. Shacham and D. Toledano-Kitai, Implementing a new strategy plan for educational change in a college of engineering. *International Consortium for Educational Development (ICED)*, Stockholm, Sweden, June, 2014.

D. Toledano-Kitai, The TLC activities in OBC. *8th International Meeting. Victor Frankl Hochschule University College of Teacher Education*, Klagenfurt, Austria, November, 2014**.**

D. Pundak, O. Herskovits and M. Shacham**,** Reading habits and fragile knowledge in physics introductory courses. American Association of Physics Teachers – Summer Meeting, Portland, OR, USA, 13-17 July, 2013.

D. Pundak, M. Shacham and O. Herskovits, Integrating online assignment checking in introductory courses. Informing Science + IT Education Conferences (InSite), Porto, Portugal, 1-6 July, 2013.

NON REFEREED CONFERENCE PROCEEDINGS AND ABSTRACTS

M. Rosenfeld, and **M. Shacham,** Career development program's contribution to the career adaptability of students' work in progress. *11th ORT Braude College Interdisciplinary Research Conference*, Hagoshrim, Israel, 2015.

S. Tidhar, **M. Shacham**, **D. Toledano-Kitai** and **D. Pundak,** Effective student mentoring - work in progress. *11th ORT Braude College Interdisciplinary Research Conference*, Hagoshrim, Israel, 2015.

D. Pundak, **M. Shacham**, and **R. Weiser- Biton,** Evaluation of critical thinking in engineering college. *10th ORT Braude College Interdisciplinary Research Conference*, Nahariya, Israel, 2014.

R. Weiser-Biton, **M. Shacham** and **D. Pundak,** Active and traditional learning in chemistry. *10th ORT Braude College Interdisciplinary Research Conference*, Nahariya, Israel, 2014.

M. Shacham and **R. Weiser- Biton,** "From good to excellent"- Coaching for success. *9th OBC Interdisciplinary Research Conference*, Hagoshrim, Israel. October, 2013.

GRANTS

Tempus grant within KA2 –Cooperation for innovation and the exchange of good practices – Capacity Building in the field of Higher Education. Tempus IRIS (Fostering Academic International Relations in Israeli Academic Colleges), October 2012-February 2016.

Erasmus+ grant within KA2 –Cooperation for innovation and the exchange of good practices –Capacity Building in the field of Higher Education. IN2IT (Internationalization by Innovative Technologies), October 2015-October 2018.

Department of English Studies

Dr. Linda Weinberg, Ph.D.,
Head of the Department

RESEARCH AREAS

ENGLISH MEDIUM INSTRUCTION

Linda Weinberg and **Miriam Symon** (Interdisciplinary Center, Herzliya)

The governing principle in most English medium instruction (EMI) courses is that content should dictate the kind of language support that is needed. Language is thus seen as a means to an end rather than the end product itself. The growing phenomenon of content courses taught in English to non-English speaking students in non-English speaking environments, however, creates a new situation where improvement of language proficiency can be part of the course objectives. This objective can only be achieved by ensuring that a suitable support framework is in place, both for the students and the teachers, enabling an integrated approach to language and content. Our research addresses the development of this support framework and will contribute towards the formulation of a coherent language policy at both institutional and national levels in Israel.

Keywords: English medium instruction, language policy, support framework

CHILDREN'S LITERATURE

Lauren Berman

In recent years, my research has focused on children's literature in general and on J. K. Rowling's Harry Potter series, specifically. I have published several articles on the demonic motifs and philosophy of evil in Rowling's works.

Keywords: Children's literature, Harry Potter, philosophy of evil

MOBILE LEARNING

Lauren Berman

My current area of interest is mobile learning and the use of tablets and iPads in the classroom, including content creation, collaborative learning, personalized learning and flipping the classroom. Other areas covered in my research include the creation and use of digital content, programming machines and social media and their application in the language-learning classroom.

Keywords: Mobile learning, digital skills, iPads and tablets

THE THINKING APPROACH TO LANGUAGE LEARNING

Suzy Esquenazi Cohen and **Linda Weinberg**

Our research investigates the relevance and applicability of critical thinking skills to language learning, through applying the Thinking Approach, a post-communicative teaching method with the emphasis on problem solving, which develops language and thinking skills simultaneously.

Keywords: Language learning, critical thinking, post-communicative, problem-solving

LEARNER MOTIVATION AND AUTONOMY IN TECHNOLOGY-ENHANCED LANGUAGE LEARNING CONTEXTS

Linda Weinberg

Motivational factors in language learning are complex. Most research indicates that there is a correlation between positive affective states and additional incentives to learn. Modern technology provides multiple opportunities for enhancing the learning experience and facilitating autonomy, but cannot guarantee increased motivation to learn. This research investigates the changes in technology used in a formal language learning setting and associated learner attitudes.

Keywords: Language learning, motivation, autonomy, technology

ACCEPTED FOR PUBLICATION

L. Weinberg, Motivation, language learning and technology. In: D. S. Guinda and R. Breeze (Eds.), *Four keywords in English-medium universities: Creativity, critical thinking, autonomy and motivation* (in press). Springer: London.

L. Berman, The invisible evils in Harry Potter. *Childhood: Study and Research of Children's Culture*, *1*, 191-211, 2015.

L. Berman, Culture and disease in *The X-Files*. *Journal of Popular Culture* (under revision).

BOOKS AND CHAPTERS IN BOOKS

M. Symon and **L. Weinberg,** To what extent does the integration of content and language in tertiary-level education improve students' English proficiency?, *Proceedings of the 3rd ICLHE Conference*, Maastricht University, The Netherlands, 11-13 April, 2013.

L. Berman, The philosophy of evil in Harry Potter. (Under Revision, Taylor & Francis publishers).

ORAL PRESENTATION AT INTERNATIONAL CONFERENCES

L. Weinberg and **M. Symon**, Crossing borders: The challenges and highlights of a collaborative approach to course development involving content and language specialists in four countries. *4th ICLHE Conference*, Brussels, Belgium, 2–4 September, 2015.

M. Symon and **L. Weinberg,** Redesigning tertiary level EFL courses through connecting, learning and growing. *European Conference on Language Learning (ECLL)*, Brighton, UK, 9-13 July, 2014.

M. Symon and **L. Weinberg,** To what extent does the integration of content and language in tertiary-level education Improve students; English proficiency? *3rd ICLHE Conference*, Maastricht University, The Netherlands, 11-13 April, 2013.

NON REFEREED CONFERENCE PROCEEDINGS AND ABSTRACTS

L. Weinberg and **S. Esquenazi Cohen**, Implementing the thinking approach in language learning in higher education. *11th ORT Braude Interdisciplinary Conference*, Hagoshrim, Israel, 2015.

M. Symon and **L. Weinberg**, Redesigning tertiary level EFL courses on a national scale. *Proceedings of The European Conference on Language Learning*, pp. 119-128, Brighton, UK. Japan: The International Academic Forum, 2014. ISSN: 2188-112X.

L. Weinberg, From "TEMPUS - English for All" to "ERASMUS for All". *9th ORT Braude Interdisciplinary Conference*, Hagoshrim, Israel, 2013.

M. Symon and **L. Weinberg**, Maximizing the impact of teaching in English in higher education: Perceptions from Israel. *Winter Forum Magazine of the European Association for International Education, EAIE*, The Netherlands, 2013.

M. Symon and **L. Weinberg**, To what extent does the integration of content and language in tertiary-level education improve students' English proficiency? *ICLHE Conference Proceedings*, Maastrich University, The Netherlands, 11-13 April, 2013.

A. M. Andreou, V. Kalogerou, L. Weinberg and H. Maoz, The development and implementation of the 'ELITE' course with the support of the LPS. *EDULEARN13 Proceedings, 5th International Conference on Education and New Learning Technologies***,** Barcelona, Spain, 1-3 July, 2013.

GRANTS

2013 – 2016 TEMPUS: European grant for ECOSTAR project

2010 - 2013 TEMPUS: European grant for EFA project

List of OBC Researchers

FIRST & FAMILY NAME	E-MAIL
Buma Abramovitz	abbuma@braude.ac.il
Samy Abu-Salih	samyas@braude.ac.il
David Alperstein	davida@braude.ac.il
Michal Amit	mamit@braude.ac.il
Gideon Avigad	gideona@braude.ac.il
Ronen Avni	ravni@braude.ac.il
Renata Avros	ravros@braude.ac.il
Roza Azhari	razhari@braude.ac.il
Zeev Barzily	zbarzily@braude.ac.il
Emil Bashkansky	ebashkan@braude.ac.il
Illana Bendavid	illana@braude.ac.il
Uri Ben-Hanan	ubenhana@braude.ac.il
Gabriel Ben-Simon	gabib@braude.ac.il
Miryam Berezina	berezm@braude.ac.il
Jorge Berger	jorge.berger@braude.ac.il

FIRST & FAMILY NAME	E-MAIL
Lauren Berman	laurenb@braude.ac.il
Mark N. Berman	berman@braude.ac.il
Orit Braun Benyamin	bborit@braude.ac.il
Daud Daud	daud13@braude.ac.il
Shuki Dror	dror@braude.ac.il
Erella Eisenstadt	erella@braude.ac.il
Eduard Eitelberg	eitelberg@braude.ac.il
Mark Elin	mark_elin@braude.ac.il
Emma Elkind	eelkind@braude.ac.il
Suzy Esquenazi Cohen	suzycohen@braude.ac.il
Ofer Eyal	ofereyal@braude.ac.il
Hana Faiger	hfaiger@braude.ac.il
Doron Faran	dfaran@braude.ac.il
Avner Fleischer	avner.fleischer@braude.ac.il
Zakharia Frenkel	zfrenkel@braude.ac.il
Alex Frid	afrid@braude.ac.il
Yael Furman-Shaharabani	yaelfsha@braude.ac.il
Tamar Gadrich	tamarg@braude.ac.il
Nirit Gavish	nirit@braude.ac.il

FIRST & FAMILY NAME	E-MAIL
Evgeny Gershikov	eugeny11@braude.ac.il
Aviv Gibali	avivg@braude.ac.il
Michael Gladshtein	mgladsht@braude.ac.il
Valery Glizer	valery48@braude.ac.il
Idit Golani	igolani@braude.ac.il
Mati Golani	matig@braude.ac.il
Ayelet Goldstein	ayelet@braude.ac.il
Alex Goldvard	goldvard@braude.ac.il
Maria Grozovski	mgrozovs@braude.ac.il
Dafne Guetta	dafneguetta@braude.ac.il
Nicholas Harris	nharris@braude.ac.il
Ilan Hefter	ihefter@braude.ac.il
Shimshon Kallush	shimshonkallush@braude.ac.il
Lavi Karp	karp2@braude.ac.il
Haggai Katriel	katriel@braude.ac.il
Ilana Kepten	ikepten@braude.ac.il
Sivan Klas	sivanklas@braude.ac.il
Dafna Knani	dknani@braude.ac.il
Katerina Korenblat	katerina@braude.ac.il

FIRST & FAMILY NAME	E-MAIL
Samuel Kosolapov	ksamuel@braude.ac.il
Danny Kottick	kotek@braude.ac.il
Hagit Krisher	hevenzur@braude.ac.il
Ehud Kroll	kroll@braude.ac.il
Lilach Iasur Kruh	iasur@braude.ac.il
Marina Levenshtein	marlev@braude.ac.il
Nissan Levtov	nissan@braude.ac.il
Steve Lipson	sglipson@braude.ac.il
Yakov Lutsky	yalutsky@braude.ac.il
Said Mahajna	said@braude.ac.il
Arie Maharshak	am@braude.ac.il
Yariv Marmor	myariv@braude.ac.il
Rami Masri	ramim@braude.ac.il
Sergey Mazin	sergeymazin@braude.ac.il
Beniamin Mounits	mounits@braude.ac.il
Orna Muller	ornamu@braude.ac.il
Hussein Naseraldin	nhussein@braude.ac.il
Nathan Netzer	netzer@braude.ac.il
Victor Ostrovski	vostrovs@braude.ac.il

FIRST & FAMILY NAME	E-MAIL
Hilla Peretz	hillap@braude.ac.il
David Pundak	dpundak@braude.ac.il
Rachel Ravid	rachelr@braude.ac.il
Ira Raveh	iraveh@braude.ac.il
Elena Ravve	cselena@braude.ac.il
Eli Raz	eliraz@braude.ac.il
Michael Regev	michaelr@braude.ac.il
Amal Rouhana-Toubi	atoubi@braude.ac.il
Nissim Sabag	nsabag@braude.ac.il
Isam Sabbah	isabbah@braude.ac.il
Albert Sabban	sabban@braude.ac.il
Moshe Sade	moshesade@braude.ac.il
Shalom Sadik	shaloms@braude.ac.il
Marei Sammar	sammar@braude.ac.il
Miri Shacham	mshacam@braude.ac.il
Atef Shalabney	shalabney@braude.ac.il
Menahem Shay	menishay@braude.ac.il
Sarai Sheinvald	sarai@braude.ac.il
Boris Shnits	shnitsb@braude.ac.il

FIRST & FAMILY NAME	E-MAIL
David Shoikhet	davs@braude.ac.il
Vladislav Shteeman	vladsh@braude.ac.il
Ludmila Shvartsman	sluda@braude.ac.il
Sarit Sivan	ssivan@braude.ac.il
Avi Soffer	asoffer@braude.ac.il
Peter Soreanu	speter@braude.ac.il
Esti Stein	estein@braude.ac.il
Meir Tahan	tahanm@braude.ac.il
Fadil Tareef	fadelt@braude.ac.il
Dvora Toledano-Kitai	dvora@braude.ac.il
Elena Trotskovsky	elenatro@braude.ac.il
Vladimir Turetsky	turetsky1@braude.ac.il
Zeev Volkovich	vlvolkov@braude.ac.il
Linda Weinberg	linda@braude.ac.il
Rivka Weiser-Biton	rivkaw@braude.ac.il
Avi Weiss	avi@braude.ac.il
Miri Weiss-Cohen	miri@braude.ac.il
Iris S. Weitz	irisweitz@braude.ac.il
Fiana Yacobzon	fiana@braude.ac.il

FIRST & FAMILY NAME	E-MAIL
Orly Yahalom	oyahalom@braude.ac.il
Natalia Zaitsev	nzaitsev@braude.ac.il

RESEARCH ORT BRAUDE COLLEGE 2013-2015

ORT BRAUDE COLLEGE

51 Snunit Street Karmiel 2161002 Israel
www.braude.ac.il

ISBN 978-965-7468-02-9