

Curriculum Vitae

**AVISHAI (AVI) MANDELBAUM**

**Address**

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Technion—Israel Institute of Technology  
Technion City, Haifa 32000  
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Fax: (972) 4-8295688  
email: avim@tx.technion.ac.il  
Web: <http://ie.technion.ac.il/avim>

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10 Harav Asaf Street  
Haifa 34760  
ISRAEL  
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**Personal**

I.D. No.: 050508324

Born on January 14, 1951 in Tel-Aviv, Israel.

Married to Dorit Mandelbaum, with three children: Orr, Gil, and Ron.

**Academic Degrees**

- B.Sc. - Mathematics and Computer Science (summa cum laude, GPA 96.13/100),  
Tel-Aviv University, 1974.
- M.A. - Statistics (summa cum laude, GPA 98.58/100), Tel-Aviv University, 1977.
- M.Sc. - Operations Research, Cornell University, 1981.
- Ph.D. - Major in Probability and Statistics; Minors in Operations Research and  
Mathematics, Cornell University, 1983.

**Academic Appointments**

- 2008–2011 : Director of the Technion OCR program (Open Collaboration Research  
with IBM Haifa Research Lab and the Rambam Hospital)
- 2007– : Director of the SEE (Service Enterprise Engineering) Laboratory, IE&M,  
Technion
- 1999– : The Benjamin and Florence Free Chair in Industrial Engineering  
and Management, Faculty of Industrial Engineering and Management,  
Technion—Israel Institute of Technology
- 1995– : Professor, IE&M, Technion
- 1988–1994 : Associate Professor, IE&M, Technion
- 1987–1991 : Associate Professor of Decision Sciences, The Graduate School of Busi-  
ness, Stanford University

- 1987–1988 : Senior Lecturer, IE&M, Technion
- 1983–1986 : Assistant Professor, The Graduate School of Business, Stanford University
- 1975–1978 : System Programmer (Tenured), Tel-Aviv University Computation Center
- 1973–1974 : Programming Consultant, Tel-Aviv University Computation Center

## Teaching

General : Probability, Stochastic Processes, Operations Research, Operations Management, Service Engineering and Management, Statistics, Control;

Undergraduate: Probability, Stochastic Processes, Statistics, Service Operations, Queueing Theory and Practice; Service Engineering and Management;

PhD : Probability and Stochastic Processes - foundations, modelling, stochastic calculus; Dynamic Programming, Stochastic Control; Queueing Networks - approximations and stationarity; Linear Complementarity; Service Networks;

MBA : MIS/DSS, Computer Implementations of Mathematical Models, Linear and Integer Programming, Simulation, Production and Operations Management - cases and theory.

Service Engineering: Developed and taught a unique course to a wide audience (undergraduates, graduates), applying up-to-date research tools and real-world data.

Course material available in <http://ie.technion.ac.il/serveng>

Course described in [http://ie.technion.ac.il/serveng/References/teaching\\_paper.pdf](http://ie.technion.ac.il/serveng/References/teaching_paper.pdf)

## Research Interests

Stochastic Networks: Fluid, Diffusion and Strong Approximations; Time and State-dependent Models; Stability, Harris Recurrence and Ergodicity; Service Engineering, Manufacturing, Project-management and Product-development Networks.

Probability and Stochastic Processes: Multi-parameter Processes; Diffusion Processes, Stochastic Calculus; Weak Convergence.

Statistics: Symmetric Statistics; Statistical Decision Theory; Inference for Stochastic Processes; Data Analysis of Large Service Systems.

Mathematical Programming: Complementarity Theory, Linear Models.

Control Theory: Multiarmed Bandits; Optimal Stopping; Control of Queueing Systems.

Service Systems, in particular Tele-Services: Modeling, Design, Management, Measurements, Inference; Call/Contact Centers; Hospitals and Healthcare in general.

## Honors

INFORMS Fellow, 2011.

Technion Yanai Prize for Excellence in Academic Education, 2011.

Technion Taub Prize for Academic Excellence, 2011.

Hong Kong University of Science and Technology (HKUST), SENG Distinguished Visiting Fellow, 2011.

Georgia Tech, ISyE Distinguished Lecturer, 2011.

University of Eindhoven's LOIS Lecture, 2010.

Technion Excellence in Teaching, 2009.

Inaugural Service Research Innovation Award for the best collaborative practice between industry, academia and government, Santa Clara, 2009: Director of project (jointly with IBM Research, Rambam Hospital, IE Technion).

ORSIS (OR Society of Israel) Prize for best publication, 2009 (with Sergey Zeltyn)

Plenary lecture: Inaugural Markov lecture in Applied Probability ("QED Q's", INFORMS 2005, San Francisco).

Meir Rosenblatt Prize for Teaching, IE&M, Technion, 2004.

Technion Mitchner Prize for Quality Sciences and Quality Management, 2003.

Yosef Levy ORSIS (OR Society of Israel) Prize, 2001.

Senior Fellow of the Wharton Financial Institutions Center, 2000–.

Technion Excellence in Teaching, 2000, for the course "Service Engineering".

Technion Salomon Simon Mani Award for Excellence in Teaching, 1999.

Marcel F. Neuts Applied Probability Award, 1997.

Japan Society for the Promotion of Science (JSPS): Visiting Fellowship, July 1995.

Fellow of the Stanford Business School Trust Fund, 1989–1990.

Fellow of the Bat-Sheva de Rothchild Foundation, 1987–1988.

Alon Israeli Young Scientist, 1987–1990.

Milton and Lilian Edwards Technion Academic Lectureship, 1987–1988.

Cornell University Fellowships: First Year Graduate Fellowship, 1978–1979; Allen Seymour Olmstead Fellowship, 1979–1980; Sage Graduate Fellowship, 1980–1982.

Tel-Aviv University Graduate Scholarships, 1976–1977.

## Grants

The Gordon Center for Systems Engineering: “Development of a Data-Based System for Simulating Call Centers, with Further Applications to Emergency Departments”, \$21,000, 2009–10.

The Israel Science Foundation (ISF): “Data-Based Analysis of Queueing Systems in the Halfin-Whitt (QED) Regime”, 4-year grant, 2008–2012, over 200,000 IS per year.

IBM OCR (Open Collaborative Research) grant: with D. Gopher and A. Shtub, jointly with IBM Research (Oded Cohen) and Rambam Hospital (Rafi Beyar), 2008–2010, \$200,000; 2010, \$50,000; grant director 2009–11.

The Binational Science Foundation (BSF): “Analysis and Control of Many-Server Queueing Systems”, jointly with M. Armory (NYU), L. Brown (Wharton), H. Kaspi (Technion), K. Ramanan (Carnegie Mellon), N. Shimkin (Technion) and W. Whitt (Columbia), 4-year grant 2007–2010, approximately \$22,000 per year.

SEE (Service Enterprise Engineering) Center: \$1 million donation to IE&M, Technion (by Harold & Inge Marcus), 2007–2010, Founding Director.

IBM Faculty Fellow: “Data-Repository for Call/Contact Centers”, jointly with Paul Feigin, 2006, 70,000 IS; extended 2007, 45,000 IS.

The Israel Science Foundation (ISF): “Statistical Models for Customer Behavior in Tele-Services: Telephone Call Centers and Contact Centers”, Cooperating Investigator to P. Feigin (PI); 3-year grant 2004–2007, approximately 120,000 IS per year.

The Binational Science Foundation (BSF): “Large-Scale Tele-Queues”, jointly with N. Shimkin (Technion), M. Armory (NYU), L. Brown (Wharton) and W. Whitt (Columbia), 4-year grant 2003–2006, approximately \$22,000 per year.

The National Science Foundation (NSF), U.S.A.: “Telephone Call Centers—Performance, Design and Control of Time-Varying Queues”, a consultant for a funded proposal by W.A. Massey, Department of Operations Research and Financial Engineering, Princeton University, 2002–2004, \$300,000.

The Israel Science Foundation (ISF): “Control of Many-Server Queues in Heavy Traffic”, jointly with Rami Atar, Technion EE; 4-year grant 2003–2006; average yearly budget \$60,000.

Lower Saxony Ministry of Education and Science: “Service Engineering and Management of Call/Contact Centers”, jointly with Stefan Helber, Technical University of Clausthal, Germany; 1-year grant, 2003, 100,000 Euros.

The National Science Foundation (NSF), U.S.A.: “Service Engineering of Human Tele-Queues: Empirically-Based Stochastic Analysis of Telephone Call Centers”, a consultant for a funded proposal by L. Brown, N. Gans and L. Zhao, the Wharton Business School, NSF Initiative on Engineering the Service Enterprise, 2002–2003, \$150,000.

The Davidson Applied Research Fund: “Exploring Queueing Systems with Impatient Customers: Empirically-Based Analysis of Telephone Call Centers”, jointly with S. Zeltyn, April 2002, \$6,000.

Technion Research Grant, \$20,000 to support “Data Analysis of Contact Centers”, 2000–2001.

The Israel Science Foundation (ISF): “Tele-Services: Performance Analysis of Stochastic Service Networks with Rational Customers”, jointly with Nahum Shimkin, Technion EE; 3-year grant 1999–2002; average yearly budget 195,000 IS.

Technion Research Grants, 1987–1989, 1992– , Principal Investigator.

Stanford Institute for Manufacturing and Automation (SIMA), Grant 1ACC638, Stanford University, 1989–1991: “From Project to Process Management: Empirically-Based Models of Engineering Product Development”. Principal Investigator, jointly with Paul Adler - Stanford IE. Participating: Vien Nguyen - MIT Sloan and Liz Schwerer - Stanford (GSB).

Postdoctoral Fellow, National Science Foundation (NSF), Grant ECS-8603857, Stanford University, 1986–1987: “Stochastic Networks.” Principal Investigator: J.M. Harrison.

Semi-Conductor Research Corporation (SRC), Contract 83-01-046, Stanford University, 1986–1987: “Computer-Integrated Manufacturing Science for Ultra Large Scale Integration Systems (Factory Modelling Project).” Principal Investigator: J.D. Meindle; Project Leader: J.M. Harrison.

## **Editorial and Professional Activities**

ISF Panel Reviews, 2011.

APS 2011, Stockholm, Sweden, Program Committee, Invited Tutorial.

MSOM Conference, Technion: Organized 2 sessions (6 lectures), SEE-sponsored, on Empirically-based Research in Call-Centers and Hospitals.

BSF Panel Reviews, 2009.

Associate Editor, *Queueing Systems: Theory and Applications (QUESTA)*, 1994–2008.

Associate Editor, *Management Science*, 1997–2008.

Senior Associate Editor, *Manufacturing and Service Operations Management (M&SOM)*, 2003–2006.

Associate Editor, *Mathematics of Operations Research (MOR)*, 1990–1999.

INFORMS Lanchester Prize Committee, 2006–2008.

APS (Applied Probability Society) Awards Committee, 2006–2008 (Chair, 2007).

International Advisory Committee: The 2005 IEEE International Conference on Service Operations, Logistics and Informatics, Beijing, August 2005.

Program Committee: 13th INFORMS Applied Probability Conference, Ottawa, July 2005.

Program Committee: 12th INFORMS Applied Probability Conference, Beijing, June 2003.

Organizing Committee: Call Center Workshop, CRM (Center for Mathematical Research), Montreal, July 2004.

Program Committee: The 14th International Symposium on Transportation and Traffic Theory, Jerusalem, 1998.

Program Committee: The Eleventh International Conference of the Israel Society for Quality, Jerusalem, November 1996.

Session Organization: Stochastic Networks, 3rd World Congress of the Bernoulli Society and 57th Annual Meeting of the IMS, June 1994.

Program Committee: INRIA/ORSA/TIMS/SMAI Conference on Applied Probability, Paris, June 1993.

Session Organization: Bandit Processes, INRIA/ORSA/TIMS/SMAI Conference on Applied Probability, Paris, June 1993.

Session Organization: Hierarchical Modelling of Queueing Networks, ORSA/TIMS Conference, Philadelphia, October 1990.

On organization, advisory and prize committees of various conferences.

Reviewer for the Annals Prob., Annals Stat., Math. OR, Mgt. Science, SIAM J. on Control and Optimization, J. of Multivariate Anal., JASA, NSF (Probability, Statistics, Operations Research and Production Systems), and more.

## **Administration**

ORSIS Mehrez Prize Committee, 2010.

OCR Technion Director, 2008–.

Faculty advisor to outstanding students, 1995–.

Faculty advisor to foreign students, 2008–.

Technion representative in European IE-Cluster meeting, Lisbon, Portugal, May 2009.

SEE (Service Enterprise Engineering) Laboratory, Director, 2007–.

Gruenblat Prize coordinator, Technion IE&M, 2005–.

Faculty Undergraduate-Studies Committee IE&M, 2005–.

Faculty Development Committee, 2004–2005, 2009–2010.

Area Head, Statistics, 2003–2004, 2008–.

Yosef Levy ORSIS Prize Committee, 2003.

Faculty committee for graduate teaching, 2003–2004.

Technion Academic Development Committee, 2000–2002.

Faculty committee for relations with industry, 1995–2000.

Technion Representative to Mil (Israel Center for Management), 1996–.

Associate Dean for Research, Faculty of Industrial Engineering, Technion, 1997–2000.

Davidson School steering committee, 1996–1998.

Technion Prize Committee, 1996–1997.

MBA committee, 1995–1997.

Israeli Council for Higher Education: Subcommittee for Evaluating the academic program on Hotel Management and Tourism, at Beer Sheba University, 1994–1997.

Head of Graduate Studies, Faculty of Industrial Engineering, Technion, 1992–1994.

Area Head, Operations Research, 1991–1992.

### **Consulting Activities**

Genesys: Consulting and Teaching, 2005–2006.

IBM Research, Consulting, 2004, 2006–.

Foreign Expert on Service Engineering, The IAO Fraunhofer Institute, Stuttgart, Germany, 2000–2003.

Senior Research Associate, Wharton’s Call Center Forum, within the Financial Institutions Center, 1999–.

Regular Visiting Scholar and Consultant, Bell Laboratories, Math. Research Center at Murray Hill, USA, 1990–2003.

Projects for and workshops with numerous service organizations, in the public and private sector, including government ministries, local municipalities, national corporations, banks, hospitals and more.

Research advisor for corporations, consulting firms, etc.

### **Conferences and Lectures**

IMS Western Regional Meeting, California Polytechnic State University, San Luis Obispo, Cal, June 1985: “Multi-armed Bandits”, invited lecture.

ASA-ENAR-WNAR-IMS Joint Statistical Meeting, Las Vegas, August 1985: “Multi-armed Bandits and Multi-parameter Processes”, invited IMS lecture.

Workshop on Stochastic Differential Systems, Stochastic Control Applications, The Institute for Mathematics and its Applications, University of Minnesota, June 1986: “Navigating and Stopping Multi-parameter Bandit Processes”, **invited resident and speaker**.

Fourth International Symposium on Statistical Decision Theory, Purdue University, June 1986, session-chair invitation.

The 16th Conference on Stochastic Processes and their Applications, Stanford University, Stanford, CA, August 1987: “Stochastic Flow Networks”, invited speaker.

The Israeli International Conference of Mathematics, Tel-Aviv University, Israel, March 1988: “Some Solvable Two Dimensional Brownian Control Problems”, invited speaker.

The Israeli International Conference of Operations Research, Tel-Aviv University, Israel, May 1988: “Approximations of Queueing Networks”, invited speaker.

The Technion International Conference on Matrices, Haifa, Israel, January 1989: “Dynamic Complementarity Problems”, invited speaker.

Workshop on Applied Stochastic Systems, Imperial College, London, April 1989: “Stochastic Leontief Systems”, invited speaker.

The Israeli International Conference of Operations Research, Beer-Sheva University, Israel, June 1989: “Stochastic Networks and Linear Complementarity”, invited speaker.

IMS-AMS-SIAM Summer Conference on Sequential Search and Selection in Real Time, Amherst, Massachusetts, June 1990: “Bandit Processes”, invited speaker.

ORSA/TIMS Conference, Philadelphia, October 1990: invited to organize a session on “Hierarchical Modeling of Queueing Networks”; speaker on “Micro, Meso and Macro Models of Queueing Networks”.

ORSA/TIMS Conference, Philadelphia, October 1990: “The Dynamic Complementarity Problem”, invited speaker.

ORSA/TIMS Western Regional Conference, Monterey, California, December 1990: “Hierarchical Modeling of Stochastic Networks”, invited speaker.

Summer School on Scheduling Theory and its Applications, Chateau de Bonas, France, September 1992: “Bandit Processes”, invited speaker.

2nd IMS International Symposium on Probability and its Applications, Bloomington, Indiana, March, 1993: “Weak Convergence of Queueing Networks”, invited speaker.

INRIA/ORSA/TIMS/SMAI Conference on Applied Probability, Paris, June 1993: invited to organize a session on “Multiarmed Bandits”; speaker on “Bandit Processes”.

Workshop on Applied Probability, Cornell University, Ithaca N.Y., June 1993, in honor of N.U. Prabhu: “Stochastic Networks”, **plenary speaker**.

IMA Program for 1993–1994 in Emerging Applications of Probability, Minnesota, February–March, 1994: “Service Networks (Dynamic, Stochastic)”, **invited resident and speaker**.

Meeting in honor of E. Dynkin, May 1994, Cornell University, Ithaca, N.Y., “Brownian Bandits”, invited speaker.

3rd World Congress of the Bernoulli Society and 57th Annual Meeting of the Institute of Mathematical Statistics, June 1994, The University of North Carolina, Chapel Hill: invited to organize a session on “Stochastic Networks”; speaker on “Hierarchical Modelling”.

TIMS XXXIII Conference, Singapore, June 1995: Tutorial on “Service Networks: Modelling, Analysis and Inference”.

Numazu International Workshop on Applied Probability, Numazu, Japan, July 1995: invited as a “**Major foreign guest**”; speaker on “State and Time-Dependent Queueing Networks”.

Kanagawa University, Japan, July 1995: Tutorials on “Approximations of Queueing Networks

and Stochastic Control”, **JSPS Fellow**.

Osaka University, Japan, July 1995: “Brownian Mice, Levy Bandits, Ito Excursions, Random Fields and even more...”, invited speaker.

Tokyo Institute of Technology, Japan, July 1995: “Queueing-prone Service Operations”, invited to **address the Queueing Society of Japan**.

Höllviken, Sweden, May 1997: “Service Measurement and Engineering”, Workshop on Telecommunications: Statistical Analysis and Performance Evaluation, ITM (Swedish Institute of Applied Math), invited speaker.

Lunteren, The Netherlands, January 1999: “Service Engineering: Modelling, Analysis and Inference of Stochastic Service Networks”, 24th Conference on the Mathematics of Operations Research, organized by CWI and LMMB (Dutch Network on Math. OR), **invited as a “main speaker”, delivered a mini-course** (4 lectures).

INSEAD, France, May 1999: “Service Engineering and Management”, Ph.D. mini-course.

Stuttgart, Germany, July 1999: “Service Engineering”, invited talk at the IAO, Fraunhofer Institute.

10th INFORMS Applied Probability Conference, Ulm, Germany, July 1999: “Designing a Call Center with Impatient Customers”, invited talk within a session on Call Centers, organized by W. Massey.

The Wharton School, University of Pennsylvania, U.S.A., February 2000: “Service Engineering and Management”, Ph.D. mini-course (Including a Statistics Seminar).

The Graduate School of Business, Stanford University, U.S.A., May 2000: “Service Engineering and Management”, Ph.D. mini-course (Including OIT Seminar).

The Wharton School, University of Pennsylvania, U.S.A., June 2000: “Service Engineering of Call Centers”, **Plenary speaker at The Call Center Forum**, Financial Institutions Center.

Milano, Italy, November 2000: “Service Engineering of Call Centers”, invited talk at the Mediolanum Bank.

Karlsruhe, Germany, November 2000: “Service Engineering—A Subjective Survey”, **plenary talk at the Conference “Service Engineering 2000”**, organized by WBK (Lehrstuhl und Institut für Werkzeugmaschinen und Betriebstechnik) of the University of Karlsruhe, jointly with IAO Fraunhofer and VDLI.

Zichron Yaakov, May 2001: “OR Applications in Services”, **plenary speaker at the ORSIS Conference** (Israeli OR Society).

Zichron Yaakov, May 2001: “Dimensioning Large Call Centers”, **Yosef Levy Biannual ORSIS Prize lecture, ORSIS Conference (Israeli OR Society)**.

Munich, Germany, May 2001: “Service Engineering”, invited talk at Siemens Research Headquarters.

The Wharton School, University of Pennsylvania, USA, May 2001: “Staffing Large Call Cen-

ters”, invited speaker at The Call Center Forum, Financial Institution Center.

CWI and The Free University, The Netherlands, June 2001: “Staffing Large Queueing Systems for both Service Quality and Efficiency”, invited to the Dutch Yearly Queueing Colloquium.

The Wharton School, University of Pennsylvania, U.S.A., April 2002: “Service Engineering and Management”, Ph.D. mini-course (Including a Statistics Seminar).

Columbia Business School, U.S.A., April 2002: “Service Engineering and Management”, Ph.D. mini-course (Including a Business School Seminar).

Mini-Courses menu of <http://ie.technion.ac.il/serveng/References/references.html>

The Wharton School, University of Pennsylvania, USA, May 2002: “A Personal Tool for Workforce Management”, invited speaker at The Call Center Forum, Financial Institution Center. <http://ie.technion.ac.il/serveng/References/aptwm.pdf>

Madrid, Spain, July 2002: “Call Centers: Queueing Theory, Science, and Practice”, invited talk, First Madrid Conference on Queueing Theory (MCQT '02).

IBM, T.J. Wharton Research Center, U.S.A., August 2002: “Service Engineering of Call/Contact Centers”, invited lecture.

Stuttgart, Germany, November 2002: “Telephone Services: Science, Engineering, Management and Teaching”, invited speaker at the First International Symposium on Service Engineering and Management.

[http://ie.technion.ac.il/serveng/References/IAO\\_Nov20\\_2002.pdf](http://ie.technion.ac.il/serveng/References/IAO_Nov20_2002.pdf)

Istanbul, Turkey, December 2002: “Service Engineering of Call Centers”, invited to Koç University.

The Wharton School, University of Pennsylvania, USA, May 2003: “Skills-Based Routing and its Operational Complexities”, invited speaker at The Call Center Forum, Financial Institution Center.

Lecture delivered: [http://ie.technion.ac.il/serveng/References/SBR\\_Wharton\\_CCFORUM\\_Short\\_May03.pdf](http://ie.technion.ac.il/serveng/References/SBR_Wharton_CCFORUM_Short_May03.pdf)

Full version: [http://ie.technion.ac.il/serveng/References/SBR\\_Wharton\\_CCFORUM\\_May\\_2003.pdf](http://ie.technion.ac.il/serveng/References/SBR_Wharton_CCFORUM_May_2003.pdf)

Eurandom, The Netherlands, September 2003: “QED Q’s”, **plenary seminar**.

CRM (Center for Mathematical Research), Montreal, Canada, July 2004: “QED Q’s”, invited speaker at the Stochastic Networks Conference, jointly with a Call-Center Workshop.

[http://ie.technion.ac.il/serveng/References/Montreal\\_QED\\_Qs\\_July\\_2004.pdf](http://ie.technion.ac.il/serveng/References/Montreal_QED_Qs_July_2004.pdf)

Tilburg University, The Netherlands, September 2004: “Service Engineering of Call/Contact Centers”, **semi-plenary speaker** at the Annual International Conference of the German Operations Research Society (GOR), jointly organized with The Netherlands Society for Operations Research (NGB).

San Francisco, U.S.A., November 2005, INFORMS: “QED Q’s”, **invited to give the Inaugural Markov Lecture of the Applied Probability Society (APS)**.

Lecture: [http://ie.technion.ac.il/serveng/References/Z\\_Lecture.pdf](http://ie.technion.ac.il/serveng/References/Z_Lecture.pdf)  
Printout: [http://ie.technion.ac.il/serveng/References/Z\\_Lecture\\_No\\_Layers\\_390H.pdf](http://ie.technion.ac.il/serveng/References/Z_Lecture_No_Layers_390H.pdf)  
APS link: [http://appliedprob.society.informs.org/markov\\_lecture.html](http://appliedprob.society.informs.org/markov_lecture.html)

Genesys Headquarters, Daly City, California, USA, November 2005: “State-of-the-Art Research of Call/Contact Centers”, invited to deliver two lectures and supervise a workshop.

Shfayim, Israel, May 2006: “QED Q’s”, invited speaker to Uri Yechiali’s Retirement Workshop.

IBM Research, Haifa, Israel, May 2006: “Service-Engineering of Call Centers”, invited speaker to IBM Business Optimization & Operations Research Workshop.

The Wharton School, University of Pennsylvania, USA, September 2006: “Service Engineering & Science: Data-Based Research, Teaching, Practice”, invited speaker and panelist at the Empirical OM Conference.

Lecture: [http://ie.technion.ac.il/serveng/References/Wharton\\_Lecture\\_Avi\\_Final.pdf](http://ie.technion.ac.il/serveng/References/Wharton_Lecture_Avi_Final.pdf)  
Printout: [http://ie.technion.ac.il/serveng/References/Wharton\\_Lecture\\_Avi\\_Printout.pdf](http://ie.technion.ac.il/serveng/References/Wharton_Lecture_Avi_Printout.pdf)

IBM SSME Conference (Service Sciences, Management, Engineering), Palisade, NY, USA, October 2006: “Service Engineering & Science: Simple Models at the Service of Complex Realities”, invited speaker (with Sergey Zeltyn).

[http://ie.technion.ac.il/serveng/References/IBM\\_SSME\\_Oct2006.pdf](http://ie.technion.ac.il/serveng/References/IBM_SSME_Oct2006.pdf)

The Graduate School of Business, Stanford University, USA, October 2006: “Service Engineering: Data-Based Research and Teaching in Support of Service Management”, Ph.D. mini-course (Including OIT Seminar).

Lecture: [http://ie.technion.ac.il/serveng/References/Stanford\\_Seminar\\_Avi.pdf](http://ie.technion.ac.il/serveng/References/Stanford_Seminar_Avi.pdf)  
Printout: [http://ie.technion.ac.il/serveng/References/Stanford\\_Seminar\\_Avi\\_Printout.pdf](http://ie.technion.ac.il/serveng/References/Stanford_Seminar_Avi_Printout.pdf)

Technion Statistics Seminar, November 2006: “Service Engineering: Data-Based Science and Teaching in Support of Service Management”.

Technion Operations Research Seminar, January 2007: “Empirically-Based Staffing in Call Centers: Simple Models at the Service of Complex Realities”.

Shfayim, Israel, May 2007: “Service Engineering”, invited workshop of the ISA Conference (Israeli Statistical Association).

Technion-Penn State joint workshop on Service Engineering, Technion, June 2007: “SEE at the Technion”.

The 32nd Conference on Stochastic Processes and Their Applications, University of Illinois at Urbana-Champaign, IL, August 2007: “QED Queues”, invited speaker.

Lecture: [http://ie.technion.ac.il/serveng/References/QED\\_Qs\\_SPA\\_FULL\\_V5.pdf](http://ie.technion.ac.il/serveng/References/QED_Qs_SPA_FULL_V5.pdf)  
Printout: [http://ie.technion.ac.il/serveng/References/QED\\_Qs\\_SPA\\_FULL\\_V5\\_NO\\_PAUSES.pdf](http://ie.technion.ac.il/serveng/References/QED_Qs_SPA_FULL_V5_NO_PAUSES.pdf)  
SPA link: <http://www.math.uiuc.edu/SPA07>

Carnegie-Mellon University, Mathematics, August 2007: “QED Q’s: Quality- and Efficiency-

Driven Call Centers”, invited speaker to the Colloquium of Probability in Industry.

Executive MBA für Technologiemanager, RWTH Aachen and the University of St. Gallen, Stuttgart, Germany, October 2007: “Service Engineering”, invited lecturer.

The Berlin Colloquium on Probability Theory, October 2007: “Many-Server Queues”.

NYU Stern Business School, New York, December 2007: “Service Science & Engineering (of QED Q’s and Call Centers)”, OM Seminar.

Technion Reunion, Class of 1967, December 2007: “Service Science & Engineering (of Call/Contact Centers)”.

[http://ie.technion.ac.il/serveng/References/ReUnion\\_1967\\_Final.pdf](http://ie.technion.ac.il/serveng/References/ReUnion_1967_Final.pdf)

Istanbul, Turkey, June 2008: “Service Engineering & Science: Data-Based Research, Teaching, Practice”, **keynote speaker, 2008 Euro Working Group on Stochastic Modeling**, Koc University.

[http://ie.technion.ac.il/serveng/References/QED\\_Qs\\_Scientific\\_Koc\\_Wharton\\_Final.pdf](http://ie.technion.ac.il/serveng/References/QED_Qs_Scientific_Koc_Wharton_Final.pdf)

Columbia Business School, U.S.A., September 2008: “Service Engineering and Management”, Ph.D. mini-course (Including a Business School Seminar).

[http://ie.technion.ac.il/serveng/References/Columbia\\_mini\\_Sep08.htm](http://ie.technion.ac.il/serveng/References/Columbia_mini_Sep08.htm)

IBM, T.J. Wharton Research Center, U.S.A., September 2008: “Service Engineering and Science”, invited lecture.

Athens, Greece, September 2008: “Service Engineering & Science: Data-Based Research, Teaching, Practice”, invited speaker, ENBIS 2008 (European Network for Business and Industrial Statistics), within ISBIS (ISI Section of the International Society for Business and Industrial Statistics).

[http://ie.technion.ac.il/serveng/References/ENBIS\\_ServEng.pdf](http://ie.technion.ac.il/serveng/References/ENBIS_ServEng.pdf)

Athens, Greece, October 2008: “QED Q’s: Quality & Efficiency-Driven Call Centers”, plenary speaker, Valuetools 2008.

Chinese National Academy of Sciences, Beijing, China, October 2008: “Service Science”, Ph.D. mini-course, at the Mathematics Department.

Tsinghua University, Beijing, China, October 2008: “Service Management, Engineering and Science”, invited talk at the Business School.

[http://ie.technion.ac.il/serveng/References/QED\\_Qs\\_Scientific\\_Generic\\_CAS%20China.pdf](http://ie.technion.ac.il/serveng/References/QED_Qs_Scientific_Generic_CAS%20China.pdf)

Fudan University, Shanghai, China, November 2008: “Service Management and Engineering”, invited talk at the Business School.

Hamil, Tel-Aviv, Israel, 3-hour lecture on “Service Engineering of Call Centers”, December 2008.

Santa Clara, U.S.A., May 2009: “Service Science in Hospitals: A Research-Based Partnership for Innovating and Transforming Patient Care”. **Winner of the Inaugural (2009) Service Science Innovation Partnership Award (Rambam, IBM, Technion).**

Shfayim, Israel, May 2009: “Staffing Many-Server Queues with Impatient Customers: Constraint Satisfaction in Call Centers”. Delivered by S. Zeltyn. **Winner of the 2009 ORSIS Best Publication Award.**

[http://ie.technion.ac.il/serveng/References/ORSIS09\\_prize.ppt](http://ie.technion.ac.il/serveng/References/ORSIS09_prize.ppt)

Istanbul, Turkey, September 2009: “Empirical Adventures in Call Centers and Hospitals”, invited to lecture and organize a session (jointly with Z. Aksin) on Service Operations, The First (2009) Workshop of the Turkish and Israeli Operations Research Societies, Bogazici University.

Technion, Excellence Program, January 2010: “Service Science and Engineering”.

Technion, Statistics Seminar, January 2010: “Empirical Adventures in Call Centers and Hospitals”.

Eurandom, The Netherlands, February 2010: “On Service Science and Engineering in Hospitals”, Healthcare Workshop, Eindhoven, invited lecture.

[http://ie.technion.ac.il/serveng/References/Eindhoven\\_ServEnginHospitals\\_February2010.pdf](http://ie.technion.ac.il/serveng/References/Eindhoven_ServEnginHospitals_February2010.pdf)

Tel Aviv, Israel, March 2010: “Service Engineering”, **Plenary lecture for the 16th Industrial Engineering and Management Conference** (also session organizer on Healthcare Engineering).

Technion, MSOM Conference, June 2010, Special Interest Group (SIG) on Services: Lecture plus Workshop on “SEESStat: Real-Time Analysis of Event-based Data from Service Operations (Call Centers, Hospitals, Internet Sites)”.

Technion, MSOM Conference, June 2010, Penn-Technion session: “Service Engineering at the Technion”.

Technion, MSOM Conference, June 2010, 2 sessions (6 lectures) on SEELab-supported research: Lectured by Armony, M., Marmor, Y., Zeltyn, S., Gurvich, I., Tseytlin, Y., Khudyakov, P.

[http://ie.technion.ac.il/serveng/References/MSOM\\_2010/MSOM\\_Main\\_Page.htm](http://ie.technion.ac.il/serveng/References/MSOM_2010/MSOM_Main_Page.htm)

National University of Singapore (NUS), August 2010: “A Data-Based Science for Service Engineering and Management”, invited seminars (Decision Sciences, Statistics).

INSEAD Singapore, August 2010: “Empirical Adventures in Call Centers and Hospitals”, invited seminar.

Eindhoven University, October 2010: “Service Science, Engineering and Management”, The **Yearly LOIS Speaker** (LOIS = Logistics, Operations and Information Systems).

The Wharton School, University of Pennsylvania, USA, December 2010: “Skills-based Routing: Exploratory Analysis and Research Prospects”, invited speaker to Larry Brown’s 70’s birthday fest.

Atlanta, U.S.A., February 2011: “Service Engineering and Science in Support of Service Management or, Empirical Adventures in Call Centers and Hospitals”, **2011 Distinguished Lecture**, ISyE, Georgia Tech.

[http://ie.technion.ac.il/serveng/References/0\\_GTech\\_Feb2011%20FINAL.pdf](http://ie.technion.ac.il/serveng/References/0_GTech_Feb2011%20FINAL.pdf)

Tel-Aviv, Israel, March 2011: “Service Engineering of Call Centers”, invited lecture, The Israeli

Call-Centers Forum.

Stockholm, Sweden, July 2011, Applied Probability Society Conference, **Invited Tutorial on Service Engineering and Science.**

Lecture: [http://ie.technion.ac.il/serveng/References/APS2011/APS\\_Part1\\_FINAL.pdf](http://ie.technion.ac.il/serveng/References/APS2011/APS_Part1_FINAL.pdf)

Related material: [http://ie.technion.ac.il/serveng/References/APS2011/APS\\_Main\\_Page.htm](http://ie.technion.ac.il/serveng/References/APS2011/APS_Main_Page.htm)

Hong Kong University of Science and Technology, September 2011: **SENG Distinguished Professorship**, Service-Engineering: Mini-course and Seminar.

[http://ie.technion.ac.il/serveng/References/HK\\_mini\\_Sep11.htm](http://ie.technion.ac.il/serveng/References/HK_mini_Sep11.htm)

[http://ie.technion.ac.il/serveng/References/HKUST\\_Seminar\\_Final.pdf](http://ie.technion.ac.il/serveng/References/HKUST_Seminar_Final.pdf)

### **Graduate Students** (ordered by starting dates)

Chen, Hong: Stochastic flow networks: bottleneck analysis, fluid approximations and diffusion limits. Ph.D., Stanford, 1987.

Pats, Genady: State-dependent queueing networks: approximations and applications. Ph.D., Technion, January, 1995.

Zeltyn, Sergey: Estimating characteristics of queueing networks using partial information. M.Sc., Technion, March, 1996. **Awarded the Poter Prize for the best dissertation in the general area of Statistics, by the Israeli Statistics Association.**

Baron, Yonit: Performance analysis of stochastic dynamic PERT networks, M.Sc., Technion, April, 1997.

Zeltyn, Sergey: Approximation of queueing networks based on transactional data, Ph.D., Technion, Qualifying Exam August, 1997. Changed subject to: Queues with impatient customers: Theory and inference combined into science, June 2004.

Garnett, Ofer: Designing a telephone call center with impatient customers, M.Sc., Technion, April, 1998. **Awarded the Students Mitchner Prize for “Quality Sciences and Quality Management”, Technion, 1999.**

Izhar, Ety (supervised jointly with N. Shimkin): Rational abandonments from invisible queues, M.Sc., Technion, December 2000.

Kestelman, Ran (supervised jointly with M. Tennenholtz): Optimal organizational structures for information processing and problem solving, M.Sc., Technion, December 2000.

Isaev, Eva (supervised jointly with E. Greenshtein): Fitting phase-type distributions to call-center data, M.Sc., Technion, June 2003.

Nakibli, Efrat: Predicting delays in telephone queues, M.Sc., Technion, February 1998–June 2003. **Awarded the Students Mitchner Prize for “Quality Sciences and Quality Management”, Technion, 2002.**

Khudyakova, Polina: Designing a call center with an IVR (Interactive Voice Response), M.Sc., Technion, June 2006.

Shaikhet, Gennady (main advisor: R. Atar): Skills-based routing in the QED regime, Ph.D.,

Technion, April 2003.

Gurvich, Itay: Design and control of the M/M/N queue with multi-type customers and many servers, M.Sc., Technion, August 2004.

Aldor, Sivan (main advisor: P. Feigin): Statistical inference of call center data, M.Sc., Technion, June 2006.

Rosenschmidt, Luba: On queues with impatient customers: Theory, approximation and simulation. M.Sc., Technion, 2006–2008.

Feldman, Zohar: Optimal staffing of systems with skills-based-routing. M.Sc., Technion, 2005–2009 (Summa Cum Laude).

Luzon, Yossi (main advisor: M. Penn): Appointment Systems. M.Sc., Technion. 2006–2009.

Yom-Tov, Galit: Performance analysis of health-care systems. Ph.D., Technion, October 2006–2010. **Research Fellowship, Israel National Institute for Health Policy (NIHP).**

Maman, Shimrit (supervised jointly with S. Zeltyn): Uncertainty in the demand for service: The case of call centers and emergency departments. MSc in Statistics, May 2007–2009. **Winner of the 2009 ORSIS Mechraz Prize for Best Graduate Thesis in Operations Research.**

Tseytlin, Yulia: Queueing systems with heterogeneous servers: On fair routing of patients in emergency departments. M.Sc., Technion, October 2007–2009. **Research Fellowship, Israel National Institute for Health Policy (NIHP).**

Reich, Michael (supervised jointly with Y. Ritov): The workload process: Modelling, analysis and inference”. M.Sc., Technion, 2008–2011.

Zviran, Asaf: On fork-join (split-match) networks (supervised jointly with R. Atar). M.Sc., Technion, 2008–2011.

Zaied, Itamar (supervised jointly with H. Kaspi): The offered load of fork-join networks, with applications to health care. M.Sc. Technion, 2009–.

Marmor, Yariv (started Ph.D. under the guidance of the late Dr. David Sinreich): Simulation support of service engineering—design, staffing and real-time control of emergency departments, Ph.D., 2006–2010. **Research Fellowship, Israel National Institute for Health Policy (NIHP).**

Senderovich, Arik: Call centers with skills-based-routing: Simulation-based state-inference and dynamic-staffing, M.Sc., January 2010–.

Carmeli, Boaz: Real-time optimization of patient-flow in emergency departments, January 2010–.

Zychlinski, Noa (supervised jointly with I. Cohen): Models in Support of Mass-Casualty-Events. M.Sc., Winter 2011–.

Ghebali, Rony (supervised jointly with M. Gorfine): Impatience over the Phone: Inference and Control. M.Sc., Winter 2011–.

Yuviler, Nitzan: IVR Design. M.Sc., 2011–.

### **Undergraduate Projects** (Industrial Engineering)

Birger Itai and Rosenthal Alon: From project to process management: power stations planning — the Israeli Electric Company, 1 year, August 1993.

Batito Ran and Reis David: Mailbox location and mail collection — the Israeli Post Office (Ilan Gonen), 1 year, October 1994.

Bokai Keren, Gochberg Hagit and Marko Rami: The Production of Justice (Management of pre-trial delay) — the Labor Court of Law, Haifa (Doron Meiblum), 1 year, September 1995.

Erhard Ran and Markin Ina: Inventory management of storage boxes — Rav-Bariach, Israel,  $\frac{1}{2}$  year, April 1995.

Horn Gad, Itman Tami, Mazuz Fabian and Neria Uri: Analysis of operating rooms — Carmel Hospital, Haifa (1 year), September 1995.

Arnon Moti, Baram Eran, Ilan Zohar, Shalski Noam: Queues of ships - Haifa Port, Israel, 1 year, April 1996.

Margalit Ido, Segev Tal, Shmilovitch Michael: From project to process management in software development — Telrad (Eitan Polak), 1 year, September 1996.

Livne Tali, Shtraus Nir, Zilberman Alex: The Production of Justice, Part II (Designing a decision support system) — the Labor Court of Law, Haifa (Doron Meiblum), 1 year, August 1997.

Ben-Nun Eitan, Dar Dan, Hochberg Yael, Shparber Elisheva: Tele-Nets - Telephone call centers — Bezek 144, Pelephone Tikshoret, Tel-Aviv Police 100, Hulon Municipality, Missing Link, Beeper, . . . , 1 year, June 1997.

Baron Ofer, Gat Yohai, Peleg Yuval: Help Desks, 1 year, Bank Leumi - Keshev (Hanania Kafri), February 1998.

Nov Yuval, Newman Igal (jointly with M. Pollatschek): Simulation and analysis to support Skills-Based Routing, 1 year, 1998–9.

Gutman Rakefet, Katmor Inbal, Rotem Efrat, Etzion Hila (jointly with Ido Erev): Shift assignments: Operations and psychology — Netvision Haifa (Shuki Lapid, Ruth Alon), 1 year, February 1999.

Guslitser Elana, Yahalom Tomer: Skills-based routing, 1 year, 1999–2000.

Schwartz Roy: Empirical and Theoretical Analysis of Many-Server Queues, 1 year, 2001.

Gurevich Itay, Harary Guy, Omer Dan: Telephone-based pizza delivery, 1 year, 2001–2002.

Arigor Menachem, Gazit Alon, Rize Daniel (jointly with B. Golany): Bug management in Intel, 1 year, 2002–2003. **Awarded the Gruenblat Prize, Technion, 2003.**

Asulin Yehuda, Terroni Gustavo Martin, Fertzenko Vladimir (Veba) : Staffing a Technical-Support Call Center—Netvision, Haifa, 1 year, 2002–2003.

Aldor Sivan, Arzi Yair: Security Checking in Ben Gurion Airport - Israeli Airport Authority (Alon Ziberstein, Eran Bushari), 1 year, **Best Project Prize**, 2003–2004.

Averhamy Meirav, Hickry Yechiel, Luzon Yossef: Skills-based routing at Bank Hapoalim (Gideon Makleff), 1 year, 2003–2004.

Feldman Zohar: Staffing of time-varying queues to achieve time-stable performance, 1 year, July 2004.

Kramer Taly, Meretzky Orly, Vinter Zahi, Pisarevski Micky: Reservation queues in Maccabi physiotherapy (Ilana Ariel), 1 year, 2004–2005.

Reich Michael, Lieber Rita, Shaviv Jenny: Specialized call centers—Nurses in Clalit; Workers’ Support in Intel, 1 year, 2005–2006.

Halamish Geva, Hauber Yoni, Harel Johnny: Workforce management at Cellcom cellular (Sharon Tamir), 1 year, 2006–2007.

Kimhi Rafi, Shmerler Kobi, Katzir Duddi: Project management at the Israeli Air Force (Izick Cohen), 1 year, 2006–2007.

Elkin Kosta, Rosenberg Noga, Levy Sharon, Yiftah Shiri: Patients’ Flow from the Emergency Department to the Internal Wards at the Rambam Hospital (Yaron Barel, Mira Shiloah), 1 year, September 2007 (Supplement: A Business Plan for RFID in the ED).

Kagan Yulia, Katz Odaya, Moses Lital; Khudiakov Polyna (Ph.D. advisor): Mortgage tele-services at Bank Hapoalim (Gidi Makleff, Zeev Hugi, Eli Aviad), 1 year, 2007–2008.

Babajani Nir, Hod Alon, Liberman Pablo: SBR at Pelephone (Shiri Yiftah, Ater Efrat), 1 year, 2008.

Kubi Yael, Shimon Sarit, Yuviler Nitzan; Luzon Yossi (Ph.D. advisor): Analysis of the Pre-Operative Process at the Rambam Hospital (Dudu Levy), 1 year, 2008.

Badran Kamal, Haas Inbal, Huli Rasha; Marmor Yariv (Ph.D. advisor): Operational Aspects of the Transition to a *Temporary* ED at Rambam Hospital (Dr. Fuad Basis), 1 year, 2008.

Badran Kamal, Haas Inbal, Huli Rasha; Marmor Yariv (Ph.D. advisor): Operational Aspects of the Transition to a *Permanent* ED at Rambam Hospital (Dr. Fuad Basis, Dr. Moshe Michelson), 1/2 year, 2008.

Gigi Liat, Koshman Keren, Rath Nitzan, Saks Yoav; Khudiakov Polyna (Ph.D. advisor): Retail Services at Bank Hapoalim (Tal Shlasky, ETTY Sol), 1 year, 2008–9.

Natur Tawheed, Valin Viki; Marmor Yariv (Ph.D. advisor): Architectures of Emergency Departments—Comparative Analysis via DEA, 1 year, 2008.

Oppenheim Yael, Raanan Navit, Ston Barak, Yaara; Marmor Yariv (Ph.D. advisor): Designing an RFID System in an Emergency Department, Rambam Hospital (Dr. Tali Freed, Dr. Dagan Schwartz), 1 year, 2009.

Paldi Ravid, Hecht Arnon, Israeli Avraham, Solo Maayan; Kutsyy Katerina (SEE Advisor): On Fusing Financial and Operational Data, Mizrahi Bank (Amitai Cohen), 1 year, 2010. Multi-

disciplinary project, jointly with E. Gerstner.

Plonski Ori, David Noa, Dourban Alon, Gologorsky Michal; Zaied Itamar (M.Sc. Advisor), Efrat Dorit (Ph.D. Advisor): Fairness in the Allocation of Work among a Hospital's Maternity Wards, Rambam Hospital (Michal Kranzler, Sara Tzafir), 2010. Multi-disciplinary project, jointly with A. Rafaeli.

Koren Abir, Yungelson Avi, Shvefed Tal, Stiro Zohar; Marmor Yariv (Ph.D. Advisor), Zychlinski Noa (M.Sc. Advisor): RFID-Based Control of a Mass-Casualty-Event (Dr. Shlomi Israelit), 1 year, 2010. Multi-disciplinary project, jointly with S. Wasserkrug, **Best Project Prize**.

## Other Projects

Hochberg Yael: Eshkol grant for research in Applied Mathematics, on “Models of telephone call-centers with abandonments”, Israeli Ministry of Science, 1996–1997.

Istzhaki Meirav, Katzav Eli, Naor Itzhak (Executive Education, Hebrew University, Jerusalem), “Direct Banking—Survey and Assessments”, 1 year, August 1998.

Yahalom Tomer: Eshkol grant for research in Applied Mathematics, on “Models of direct services: skills-based routing”, Israeli Ministry of Science, 2000–2001.

Schwartz Roy, Technion Excellent Students program: “Simulation experiments with many-server queues in the QED regime (QED = Quality *and* Efficiency Driven)”, 2002–2003.

Reichelstein Efrat, Stern Shimrit: “Reservation queues”, 2004–2005, with M. Penn.

Tseytlin Yulia, Zviran Asaf: “Simulation of patients routing from an emergency department to internal wards in Rambam Hospital”, 2008.

Plonsky Ori: “Validating models of call centers”, supervised jointly with S. Zeltyn, 2010.

Koren Abir: “On workload and offered-load programming”, 2010.

## PUBLICATIONS

### Theses

M.A. Thesis, 1977: “Optimization in the M/GI/1 Queue”, Tel-Aviv University.  
(Thesis Committee: U. Yechiali, I. Meilijson, M. Smorodinsky)

Ph.D. Thesis, 1983: “Linear Estimators of the Mean of a Gaussian Distribution on a Hilbert Space”, Cornell University.  
(Thesis Committee: E.B. Dynkin, L.D. Brown, D. Heath, L. Billera)

### Original Papers in Refereed Professional Journals

1. Mandelbaum, A. and Vanderbei, R.J. “Optimal Stopping and Supermartingales over Partially Ordered Sets”, *Z. Wahrscheinlichkeitstheorie verw. Geb.*, **57**, 253–264, 1981.
2. Mandelbaum, A. and Yechiali, U. “Optimal Entering Rules for a Customer with Wait Option at an M/G/1 Queue”, *Management Science*, **29**, 174–187, 1983.
3. Dynkin, E.B. and Mandelbaum, A. “Symmetric Statistics, Poisson Point Processes and Multiple Wiener Integrals”, *The Annals of Statistics*, **11**, 739–745, 1983.
4. Mandelbaum, A. and Taqqu, M. “Invariance Principle for Symmetric Statistics”, *The Annals of Statistics*, **12**, 483–496, 1984.
5. Mandelbaum, A. “Linear Estimators and Measurable Linear Transformations on a Hilbert Space”, *Z. Wahrscheinlichkeitstheorie verw. Geb.*, **65**, 385–397, 1984.
6. Mandelbaum, A. “All Admissible Estimators of the Mean of Gaussian Distribution on a Hilbert Space”, *The Annals of Statistics*, **12**, 1448–1466, 1984.
7. Mandelbaum, A. “Discrete Multi-armed Bandits and Multi-parameter Processes”, *Probability Theory and Related Fields*, **71**, 129–147, 1986.
8. Mandelbaum, A. and Shepp, L.A. “Admissibility as a Touchstone”, *The Annals of Statistics*, **15**, 252–268, 1987.
9. Mandelbaum, A. and Rüschendorf, L. “Complete and Symmetrically Complete Families of Distributions”, *The Annals of Statistics*, **15**, 1229–1244, 1987.
10. Mandelbaum, A. “Continuous Multi-armed Bandits and Multi-parameter Processes”, *The Annals of Probability*, **15**, 1527–1556, 1987.
11. Chen, H., Harrison, J.M., Mandelbaum, A., van Ackere, A. and Wein, L. “Empirical Evaluation of a Queueing Network Model for Semiconductor Wafer Fabrication”, *Operations Research*, special issue in Manufacturing, **36**, 202–216, 1988.
12. Mandelbaum, A., Shepp, L.A. and Vanderbei, R.J. “Optimal Switching Between a Pair of Brownian Motions”, *The Annals of Probability*, **18**, 1010–1033, 1990.

13. Chen, H. and Mandelbaum, A. “Discrete Flow Networks: Bottleneck Analysis and Fluid Approximations”, *Math. of Operations Research*, **16**, 408–446, 1991.
14. Chen, H. and Mandelbaum, A. “Stochastic Discrete Flow Networks: Diffusion Approximations and Bottlenecks”, *The Annals of Probability*, **19**, 1463–1519, 1991.
15. Kaspi, H. and Mandelbaum, A. “Regenerative Closed Queueing Networks”, *Stochastics and Stochastics Reports*, **39**, 239–258, 1992.
16. Vladimirov, A.A., Kozyakin, V.S., Kuznetsov, N.A. and Mandelbaum, A. “An Investigation of the Dynamic Complementarity Problem By Methods of the Theory of Desynchronized Systems”, *Russian Acad. Sci. Dokl. Math.*, **47**, 169–173, 1993.
17. Kaspi, H. and Mandelbaum, A. “On Harris Recurrence in Continuous Time”, *Math. of Operations Research*, **19**, 211–222, 1994.
18. Mandelbaum, A. and Massey, W. “Strong Approximations for Time-dependent Queues”, *Math. of Operations Research*, **20**, 33–64, 1995.
19. Adler, P., Mandelbaum, A., Nguyen, V. and Schwerer, E. “From Project to Process Management: An Empirically-Based Framework for Analyzing Product Development Time”, *Management Science*, **41**, 458–484, 1995.
20. Kaspi, H. and Mandelbaum, A. “Levy Bandits”, *Annals of Applied Probability*, **5**, 541–565, 1995.
21. Adler, P., Mandelbaum, A., Nguyen, V. and Schwerer, E. “Getting the Most Out of Your Product Development”, *Harvard Business Review*, March-April, 134–152, 1996.
22. Jennings, O.B., Mandelbaum, A., Massey, W.A. and Whitt, W. “Server Staffing to Meet Time-Varying Demand”, *Management Science*, **42**, 1383–1394, 1996.  
<http://ie.technion.ac.il/serveng/References/TimeVarying.pdf>.
23. Choudhury, G.L., Mandelbaum, A., Reiman, M.I. and Whitt, W. “Fluid and Diffusion Limits for Queues in Slowly Changing Environments”, *Stochastic Models*, **13**, 121–146, 1997. **Awarded the 1997 Marcel F. Neuts Applied Probability Award for Best Paper, at the INFORMS meeting in Montreal, April 1998.**
24. Mandelbaum, A. and Pats, G. “State-Dependent Stochastic Networks, Part I: Approximations and Applications with Continuous Diffusion Limits”, *The Annals of Applied Probability*, **8**, 569–646. May 1998.
25. Mandelbaum, A. and Reiman, M. “On Pooling in Queueing Networks”, *Management Science*, **44**, 971–981, July 1998.
26. Mandelbaum, A. and Zeltyn, S. “Estimating Characteristics of Queueing Networks Using Transactional Data”, *Queueing Systems: Theory and Applications (QUESTA)*, **29**, 75–127, August 1998.
27. Mandelbaum, A., Massey, W.A. and Reiman, M. “Strong Approximations for Markovian Service Networks”, *Queueing Systems: Theory and Applications (QUESTA)*, **30**, 149–201, November 1998.

28. Kaspi, H. and Mandelbaum, A. “Multi-armed Bandits in Discrete and Continuous Time”, *The Annals of Applied Probability*, **8**, 1270–1290, 1998.
29. Barlow, M., Burdzy, K., Kaspi, H. and Mandelbaum, A. “Variably Skewed Brownian Motion”, *Electronic Communications in Probability*, **15**, 57–66, 2000.
30. Mandelbaum, A. and Shimkin, N. “A Model for Rational Abandonments from Invisible Queues”, *Queueing Systems: Theory and Applications (QUESTA)*, **36**, 141–173, December 2000.
31. Zohar, E., Mandelbaum, A. and Shimkin, N. “Adaptive Behavior of Impatient Customers in Tele-Queues: Theory and Empirical Support”, *Management Science*, **48** (4), 566–583, 2002. **Awarded the Students’ Mitchner Prize for “Quality Sciences and Quality Management”, Technion, 2001.**
32. Garnett, O., Mandelbaum, A. and Reiman, M.I. “Designing a Call Center with Impatient Customers”, *Manufacturing and Service Operations Management (M&SOM)*, **4** (3), 208–227, 2002. <http://ie.technion.ac.il/serveng/References/Garnett.pdf>.
33. Koole, G. and Mandelbaum, A. “Queueing Models of Call Centers: An Introduction”, *Annals of Operations Research*, **113**, 41–59, 2002.  
<http://www.springerlink.com/content/m5170t745702125j/>  
Special volume dedicated to a selection of papers presented at the “First Madrid Conference on Queueing Theory” (MCQT ’02), July 2–5, 2002.  
Downloadable from: <<http://ie.technion.ac.il/serveng>>.
34. Gans, N., Koole, G., Mandelbaum, A. “Telephone Call Centers: A Tutorial and Literature Review”. Invited review paper by *Manufacturing and Service Operations Management (M&SOM)*, **5** (2), 79–141, 2003. **Awarded the Technion Mitchner Prize in “Quality Science and Quality Management”, May 2003.**  
<http://ie.technion.ac.il/serveng/References/CCReview.pdf>.
35. Jelenkovic, P., Mandelbaum, A. and Momcilovic, P. “Heavy Traffic Limits for Queues with Many Deterministic Servers”, *QUESTA*, **47**, 53–69, 2004.  
[http://ie.technion.ac.il/serveng/References/GDK\\_QUESTA\\_COPY.pdf](http://ie.technion.ac.il/serveng/References/GDK_QUESTA_COPY.pdf)
36. Borst, S., Mandelbaum, A. and Reiman, M.I. “Dimensioning Large Call Centers”, *Operations Research*, **52** (1), 17–34, 2004. **Awarded the Yosef Levy ORSIS Prize, at the ORSIS Conference, Zichron Yaacov, May 2001.**  
<http://ie.technion.ac.il/serveng/References/Dimensioning.pdf>.
37. Atar, R., Mandelbaum, A. and Reiman, M. “Scheduling a Multi-Class Queue with Many iid Servers: Aymptotic Optimality in Heavy-Traffic”, *The Annals of Applied Probability*, **14** (3), 1084–1134, 2004.  
<http://ie.technion.ac.il/serveng/References/AAP016.pdf>
38. Shimkin, N. and Mandelbaum, A. “Rational Abandonments from Tele-Queues. Nonlinear Waiting Costs with Heterogeneous Preferences”, *QUESTA*, **47**, 117–146, 2004.  
[http://ie.technion.ac.il/serveng/References/NonLinear\\_QUESTA\\_COPY.pdf](http://ie.technion.ac.il/serveng/References/NonLinear_QUESTA_COPY.pdf)

39. Mandelbaum, A. and Zeltyn, S. “The Impact of Customers’ Patience on Delay and Abandonment: Some Empirically-Driven Experiments with the M/M/N+G Queue”, *OR Spectrum*, **26** (3), 377–411, 2004. Special issue on Call Centers.  
[http://ie.technion.ac.il/serveng/References/pat\\_impact\\_color.pdf](http://ie.technion.ac.il/serveng/References/pat_impact_color.pdf)
40. Cohen, I., Mandelbaum, A. and Shtub, A. “Multi-Project Scheduling and Control: A Process-Based Comparative Study of the Critical Chain Methodology and Some Alternatives”, *Project Management Journal*, **35** (7), 39–49, 2004.  
[http://ie.technion.ac.il/serveng/References/MultiProject\\_Scheduling\\_and\\_Control.pdf](http://ie.technion.ac.il/serveng/References/MultiProject_Scheduling_and_Control.pdf)
41. Atar, R., Mandelbaum, A. and Reiman, M. “A Brownian Control Problem for a Simple Queueing System in the Halfin-Whitt Regime”, *Systems and Control Letters*, **51** (3–4), 269–275, 2004.
42. Mandelbaum, A. and Stolyar, A.L. “Scheduling Flexible Servers with Convex Delay Costs: Heavy-Traffic Optimality of the Generalized  $c\mu$ -Rule”, *Operations Research*, **52** (6), 836–855, 2004.
43. Brown, L., Gans, N., Mandelbaum, A., Sakov, A., Zeltyn, S., Zhao, L. and Haipeng, S. “Statistical Analysis of a Telephone Call Center: A Queueing-Science Perspective”, *JASA*, **100**, 36–50, 2005.  
[http://ie.technion.ac.il/serveng/References/JASA\\_callcenter.pdf](http://ie.technion.ac.il/serveng/References/JASA_callcenter.pdf)
44. Zeltyn, S. and Mandelbaum, A. “Call Centers with Impatient Customers: Many-Server Asymptotics of the M/M/n+G Queue”, *QUESTA*, **51** (3/4), 361–402, 2005.  
<http://ie.technion.ac.il/serveng/References/regimes.pdf>
45. Atar, R., Mandelbaum, A. and Shaikhet, G. “Queueing Systems with Many Servers: Null Controllability in Heavy Traffic”, *Annals of Appl. Prob.*, **16** (4), 1764–1804, 2006.
46. Feldman, Z., Mandelbaum, A., Massey, W.A. and Whitt, W. “Staffing of Time-Varying Queues to Achieve Time-Stable Performance”, *Management Science*, **54**, 324–338, 2008.  
<http://ie.technion.ac.il/serveng/References/Feldman2008pub.pdf>  
Internet supplement:  
<http://ie.technion.ac.il/serveng/References/Feldman2008e-companion.pdf>
47. Mandelbaum, A. and Momcilovic, P. “Queues with Many Servers: The Virtual Waiting-Time Process in the QED Regime”, *MOR*, **33** (3), 561–586, 2008.
48. Gurvich, I., Armony, M. and Mandelbaum, A. “Service-Level Differentiation in Call Centers with Fully Flexible Servers”, *Management Science*, **54**, 279–294, 2008.  
[http://ie.technion.ac.il/serveng/References/Vdesign\\_pub.pdf](http://ie.technion.ac.il/serveng/References/Vdesign_pub.pdf)  
Technical appendix:  
[http://ie.technion.ac.il/serveng/References/Vdesign\\_ecompanion.pdf](http://ie.technion.ac.il/serveng/References/Vdesign_ecompanion.pdf)
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