

May 2014

HAYA KASPI

I.D. No. : 00338279-3
Date of Birth : 6 October, 1948.
Place of Birth: Kibbutz Ha-ogen, Israel.
Family Status : Widow + 2 sons.

ACADEMIC DEGREES

B.Sc., (cum laude) Department of Mathematics, Hebrew University, 1971.
M.Sc., Department of Applied Mathematics, Technion, Israel, 1974.
Ph.D., School of Operations Research, Cornell University, Ithaca, New York, 1979.

ACADEMIC APPOINTMENTS

1997 - : Professor, Faculty of Industrial Engineering and Management,
Technion - Israel Institute of Technology.
9/2009-1/2010 Visiting Professor, Monash University. Victoria, Australia.
1-8/2005 Visiting Professor, School of Operations Research, Cornell University,
Ithaca, New York
9-12/2004 Visiting Scholar, Department of Mathematics Boston University. Boston
Massachusetts.
1998 – 1999: Visiting Professor, School of Operations Research, Cornell University,
Ithaca, New York.
1989 - 1997: Associate Professor, Faculty of Industrial Engineering and Management,
Technion - Israel Institute of Technology.
1986 - 1987: Visiting Associate Professor, School of Operations Research Cornell
University, Ithaca, New York.

- 1984 - 1988: Senior Lecturer, Dept. of Industrial Engineering and Management, Technion - Israel Institute of Technology.
- 1980 - 1983: Lecturer, Dept. of Industrial Engineering and Management, Technion - Israel Institute of Technology.
- 1979 - 1980: Post Doctoral Fellow, Dept. of Statistics, Princeton University, Princeton, N.J.

CURRENT RESEARCH INTERESTS

1. Theory of Markov Processes - excursion theory, regenerative systems, excursion theory of processes in duality, potential theory, local times, skew Brownian motion.
2. Applied Probability - Application of the above theory to storage processes and dam models, queuing networks, multi-armed bandits, fluid and diffusion limits of many server's queues

TEACHING EXPERIENCE

a) Undergraduate Courses:

- 1980 - present: Introduction to Probability (advanced)
- 1981 - 82: Introduction to Probability
- 1985 - 87, 1993: Introduction to Statistics

b) Graduate Courses:

- 1980-1982: Introduction to Stochastic Processes
- 1994-1996:
2000-2002
2006-2010:
- 1983, 1988
2008: Probability and Stochastic Processes (Markov Processes and Potential Theory)
- 1992: Excursion Theory
- 1993: Stability of Markov Processes
- 1985 – 1990: Probability Theory
- 1996 – 1998:
2002:
- 2001: The Theory of Local Times

2011 Levy Processes and Local Times of Markov Processes

TECHNION ACTIVITIES

Coordinator of Undergraduate Studies, 1989.

Head of the Field of Statistics, Jan. 1991 - Jan. 1993, Jan. 1997 - 1998.

Head of Faculty Research Center, Jan 1994 - 1996.

Member of Appeal Court for Student Discipline, 1994 - 1996.

Member of the Senate Ethics committee, 2000.

Member of Senate Awards committee, 1998.

Member of Graduate School Prize Committee, 2001-2002.

Coordinator of the Faculty of Industrial Engineering and Management Graduate Studies, 1999-2002.

Member of the Senate Research Committee, 2002-2004.

Vice Dean of the Graduate School, 2002-2004.

Member of the Senate Committee for Graduate and Undergraduate Studies, 2007– 2008.

Member of the Technion Senate Committee for Promotions and Tenure Procedures 2007-2009.

Member of the Technion Steering Committee 2011-2013

Member of Vatat Steering Committee of ICORE 2010-2011

PUBLIC PROFESSIONAL ACTIVITIES

Member of the Institute of Mathematical Statistics and the Bernoulli Society for Mathematical Statistics and Probability.

Refereed for the following journals: *Math. of O.R.*, *Stochastic Processes and their Applications*, *European Journal of O.R.*, *Z. Wahrsch. verw. Geb.*, *Applied Probability Journals*, *Opsearch*, *Journal of Theoretical Probability*, *Annals of Probability*, *Probability Theory and Related Fields*, *Annals of Applied Probability*, *Electronic Journal of Probability*.

Reviewed for N.S.F., G.I.F.

Reviewed for *Math Reviews*.

Joint organizer of the 20th Conference on Stochastic Processes and Their Applications, June 1991.

Associate Editor: *Probability Theory and Related Fields*, 1992 - April 1994.
Member of the Advisory Board of *Probability Theory and Related Fields*,
April 1994-2002.

Associate Editor: *Stochastic Processes and their Applications*, 2002-2009.

Associate Editor: *Annals of Probability*. January 2009-January 2012

Member of the committee for the Ito award for papers published in SPA 2003.

Member of the IMS committee for the IMS President and IMS council members search 2006, 2010

Member of the IMS committee for nomination of Fellow of the IMS 2010-2013 Chaired the 2013 committee

Member of the Scientific Committee of the 43 Conference of Stochastic Processes and their Applications to be held in Colorado in 2013.

Member of the the joint IMS-Bernoulli Society committee to select the Schramm and Doob Lecturers 2013-.

AWARDS

1980-1982: The Alon Award.

2008 IMS Fellow

2011 Recipient of the Ito Prize (jointly with Nathalie Eisenbaum)

SUPERVISION OF GRADUATE STUDENTS

Completed:

David Perry (Ph.D. 1983): "Inventory Systems of Perishable Commodities" (jointly with Prof. M. Rubinovitch).

Yuval Lirov (M.Sc. 1984): "Analysis of Implicit Data Communication Systems" (jointly with Dr. Yair Wand).

Orna Arad (M.Sc. 1986): "Analysis of Markovian Storage Systems".

Ofrit Shani (M.Sc. 1989): "Stochastic Market Share Models"
(jointly with Prof. U.G. Rothblum).

Shmuel Bar-On (M.Sc. 1986): "Asymptotic Behavior of Market Shares in a Stochastic Growth Model" (jointly with Prof. U.G. Rothblum).

Nimrod Bayer (Ph.D. 1995): "Closed Queueing Networks with Branching Populations"
(supervised him during the summer of 1991, while his advisor Y. Kogan was on leave).

Ilan Gilboa (M.Sc. 1996): "Economical Considerations in the Use of a Buffer in an Unreliable Machine" (jointly with Dr. Yale Herer).

Manor Gadi (M.Sc. 1998): "Branching Bandits".

Itamar Zeid (M.Sc. 2012) "The Offered Load in Fork-Join Networks: Calculationans Applications to Service Engineering of Emergency Departments" (Jointly with Prof. Avishai Mandelbaum).

IN PROGRESS

Nitzan Yubiller (M.Sc. expected 2013)"Optimizing the Design of IVR Systems as a special Case of Self Services" (jointly with Avishai Mandelbaum)

SUPERVISION OF POST DOCS

Dr. Alexander Walsh(October 2011-October 2012) The Analysis of Many Servers Queues via Measure Valued Processes".

RESEARCH GRANTS

Actions Integrees de Cooperation Scientifique et Technique entre la France et Israel:

1. 1984: (Jointly with Bernard Maisonneuve as second principal investigator).
Subject: Regenerative Systems.
Support to cover travel and local expenses from France to Israel of principal investigator.
2. 1991: (Jointly with Nathalie Eisenbaum as second principal investigator).
Subject: Ray Knight Theorems.
Support to cover travel and local expenses of principal investigators, both from France to Israel and from Israel to France.

2007–2010: BSF (Jointly with K. Ramanan, M. Armony, W. Whitt, N. Shimkin and A. Mandelbaum).

Subject: Many Server Queueing Systems.
2010-2013: ISF. Subject: Many Servers Queues- Analysis via Measure Valued Processes

2013-2017 ISF. Subject : Many Servers Queues- Analysis via Measure Valued Processes

PUBLICATIONS

Theses:

M.Sc. (1974): "The Stochastic Behaviour of a Buffer with Non-Identical Input Lines",
Dept. of Applied Mathematics, Technion.

Ph.D. (1979): "Ladder Sets for Markov Additive Processes", Cornell University.

Original Papers in Professional Journals:

Published:

1. Kaspi, H. and Rubinovitch, M., "On the stochastic behavior of a buffer with nonidentical input lines", *Journal of Stochastic Processes Appl.*, 3, 73-88, 1975.
2. Kaspi, H., "On the symmetric Wiener Hopf factorization for Markov additive processes", *Z. Wahrsch. verw. Geb.*, 59, 179-196, 1982.
3. Cinlar, E. and Kaspi, H., "Regenerative systems and Markov additive processes", *Seminar on Stochastic Processes*, 1982, 123-147, Birkhauser, Boston, 1983.
4. Kaspi, H. and Perry, D., "Inventory systems with perishable commodities", *Adv. Appl. Prob.*, 15, 674-685, 1983.
5. Kaspi, H., "Storage processes with Markov additive input and output", *Math of O.R.*, 9 (3), 424-440, 1984.
6. Kaspi, H. and Perry, D., "Inventory systems for perishable commodities with renewal input and Poisson output", *Adv. Appl. Prob.*, 16, 402-421, 1984.
7. Kaspi, H., "Excursions of Markov processes: an approach via Markov additive processes", *Z. Wahrsch. verw. Geb.*, 64, 251-268, 1983.
8. Kaspi, H., "On invariant measures and dual excursions of Markov processes", *Z. Wahrsch. verw. Geb.*, 66, 185-204, 1984.
9. Kaspi, H., "Excursion laws for Markov processes in classical duality", *Ann. of Prob.*, 13 (2), 492-518, 1985.
10. Kaspi, H. and Maisonneuve, B., "Predictable local times and exit systems". *Seminaire de Probabilites XX*, 1984/85, *Lecture Notes in Math 1204*, 95-100. Springer-Verlag, Berlin-Heidelberg-New York, 1986.
11. Kaspi, H., "Random time changes for processes with random birth and death", *Ann. of Prob.*, 16 (2), 588-599, 1988.
12. Kaspi, H. and Maisonneuve, B., "Regenerative systems on the real line", *Ann. of Prob.*, 16 (3), 1306-1332, 1988.

13. Kaspi, H. and Mitro, J.B., "Homogenous random measures for Markov processes in weak duality: study via an entrance boundary", *Stoch. Proc. Appl.*, 29 (2), 291-308, 1988.
14. Kaspi, H. and Perry, D., "On duality between a non Markovian continuous production/inventory system and a Markovian dam process with state dependent release, jump size and jump rate", *Journal of Appl. Prob.*, 27, 835-844, 1989.
15. Kaspi, H. and Mandelbaum, A., "Regenerative closed queueing networks", *Stochastics and Stochastic Reports*, 39, 230-258, 1992.
16. Eisenbaum, N. and Kaspi, H., "A necessary and sufficient condition for the Markov property of the local time process", *Ann. of Probability*, 21 (3), 1591-1598, 1993.
17. Kaspi, H. and Mandelbaum, A., "On Harris recurrence in continuous time", *Math. of O.R.*, 19 (1), 211-222, 1994.
18. Kaspi, H. and Mandelbaum, A., "Levy bandits: Multi-armed bandits driven by Levy processes", *Ann. of Appl. Probab.*, 5 (2), 541-565, 1995.
19. Eisenbaum, N. and Kaspi, H., "A counterexample for the Markov property of local time of diffusions on graphs", *Seminaire de Probabilites*, XXIX, 260-265. *Lecture Notes in Math.*, 1613. Springer, 1995.
20. Kaspi, H. and Kella, O. "Stability of feed-forward fluid networks with Levy input", *J. Appl. Probab.*, 33, 513-522, 1996.
21. Eisenbaum, N. and Kaspi, H., "A necessary and sufficient condition for the Markov property of the local time process of Markov processes with values on graphs", *Stochastic Processes and Their Applications*, 64, 153-172, 1996.
22. Kaspi, H., Kella, O. and Perry, D., "Dam processes with state dependent batch sizes and intermittent production processes with state dependent rates", *Queueing Systems*, 24, 37-57, 1996.
23. Kaspi, H. and Mandelbaum, A., "Multi armed bandits in dDiscrete and continuous time", *Ann. Appl. Probab.*, 8 (4), 1270-1290, 1998.
24. Gilboa, I. Herer, Y., Kaspi, H. and Raz, Z., "Optimal design of the inspection buffer for an unreliable process", *Int. J. Prod. Res.*, 38 (1), 187-205, 1999.
25. Kaspi, H. and Rosen, J., "p-variation for families of local times on lines", *Seminaire de Probabilites*, XXXIV, 1999, pp. 171-184 in *Lecture Notes in Mathematics*, 1728, Springer, 2000.
26. Barlow, M., Burdzy, K., Kaspi, H. and Mandelbaum, A., "Variably skewed Brownian motion", *Electronic Communications in Probability*, 15, 57-66, 2000.

27. Eisenbaum, N., Kaspi, H., Marcus, M.B., Rosen, J. and Shi, Z., "A Ray Knight theorem for symmetric Markov processes", *Ann. of Probab.*, 28 (4), 1781-1796, 2000.
28. Barlow, M., Burdzy, K., Kaspi, H. and Mandelbaum, A., "Coalescence of skew Brownian motions", *Seminaire de Probabilities*, XXXV, 202-206, LNM 1755, Springer, 2001.
29. Burdzy, K. and Kaspi, H., "Lenses in skew Brownian flows", *Ann. of Probab.*, 32 (4), 3085-3115, 2004.
30. Boxma, O., Kaspi, H., Kella, O. and Perry, D., "On/off storage system with state dependent input, output and switching rates", *Probability in Engineering and Informational Sciences*, 19, 1-14, 2005.
31. Eisenbaum, N. and Kaspi, H., "A characterization of the infinite divisible square Gaussian processes", *Ann. of Probab.*, 34 (2), 728-742, 2006.
32. Eisenbaum, N. and Kaspi, H. "On the continuity of local times of Borel right processes, *Ann. of Probab.*, 15 (3), 915-934, 2007.
33. Eisenbaum, N. and Kaspi, H. "On Permanental processes". *Stoch. Proc.and Appl.* 119(5) 1401-1415. 2009.
34. Kaspi, H. and Ramanan, K. "Law of large number limits for Many Server Queues" *Ann. of Appl. Probab.* 21(1), 33-114, 2011.
35. Kaspi, H. and Ramanan, K. SPDE limits of Many Server Queues. *Annals of Applied Probability* 23(1) 145-229, 2013

Papers in Refereed Collections:

36. Kaspi, H. and Rubinovitch, M., "Regenerative sets and their applications to Markov storage systems". In O. Boxma and R. Syski (eds.), *Liber Amicorum for J.W. Cohen*, 413-427. North Holland, 1988.
37. Kaspi, H. and Rubinovitch, M., "A limit theorem on the output of $G1/M/\infty$ queues. In Bhat and Basawa (eds.), *Queueing and Related Models*, 105-111, Clarendon Press, Oxford 1992.

Chapters in Books:

1. Kaspi, H. and Maisonneuve, B., "Stationary regenerative systems". In: *Semi-Markov Models: Theory and Applications*, 13-22, Plenum, 1986.
2. Kaspi, H., Mandelbaum, A. and Vanderbei, R., "Bandit processes: control, analysis and characterization". In: *Scheduling Theory and Its Applications*, pp. 337-347, Wiley, 1995.

Accepted.

1. Atar, R., Kaspi, H., . Shimkin, N. "Fluid limits of many servers systems with renegeing under priority policy" to appear in *Mathematics of Operations Research*..

Submitted

1. Atar, R. Biswas, A. and Kaspi, H. Fluid Limits of G/G/1+G Queues under non-preemptive Earliest-Deadline-First discipline. Submitted to *Mathematics of Operations Research*.
2. Barbour, A.D., Hamza, K. Kaspi, H and Klebaner, F. Escape from the boundary in Markov population processes. Submitted to *Electronic Journal of Probability*.

CONFERENCES***Invited Papers:***

12th Conference on Stochastic Processes and Their Applications, Cornell University July 1983, "Excursions and Invariant Measures for Markov Processes".

Seminar on Stochastic Processes, Gainesville, Florida, March 1983, "On Invariant Measures and Dual Excursions for Markov Processes".

International Symposium on Semi-Markov Processes and their Applications, Brussels, Belgium, June 1984, "Stationary Regenerative Systems".

Fourteenth Conference on the Mathematics of Operations Research, Lunther, The Netherlands, February 1989:

- (i) "Stationary Regenerative Systems on the Real Line.
- (ii) "Applications of Regenerative Systems to Markovian Storage Systems".

Workshop in Applied Probability in Honor of Prof. N.U. Prabhu, Cornell University, June 1993. Organized a session on Levy Processes and Their Applications and talked on "Levy Bandits: Multi-armed Bandits Driven by Levy Processes" (joint with Avi Mandelbaum). Speaker: H. Kaspi.

Annual Meeting of the Israeli Statistical Association Zihron Yaakov April 2006. "On Infinitely Divisible Square Gaussian Processes".

Markov Processes Day in honor of Prof. E. Cinlar. Princeton University. March 2006. "On the Continuity of Local Times of Borel Right Processes".

INFORMS, Pittsburgh, November 2006, "Fluid Limits for Many Server Queues".

The Annual meeting of ORSIS. Maale Hahamisha, May 2007 "Fluid Limits of Many Servers Queues".

International Workshop in Applied Probability 2008 Compiègne France July 2008. "Fluid and Diffusion Limits of Many Servers queues

Applied Probability Society (APS INFORMS) Meeting Cornell July 2009 " Fluid and Diffusion Limits of Many Servers Queues"

INFORMS, San Diego October 2009 "Measure Valued Diffusion Limits of Many Servers Queues"

Stochastic Networks Conference Cambridge UK 19-26 March 2010. . "SPPDE Limits of Many Servers Queues"

41 Conference on Stochastic Processes and their Applications 2011 Oaxaca Mexico June 2011 . Ito Prize Lecture "On Permanent Processes"

INFORMS 2011. Charlotte NC, November 13-17. "Optimal Control for Parallel Server Model in Equilibrium of the Fluid Limit Using Measure Valued Processes".

International Workshop in Applied Probability 2012 Jerusalem June 2012 Fluid Limits of multi class many servers queues with reneging. An approach via measure valued processes"

Workshop on Optimization Scheduling and Queues in honour of Prof. Gideon Weiss. Haifa 2012. "Many Servers Queues an Approach via Measure Valued Processes"

8-th World Congress in Probability and Statistics Istanbul July 2012. Organizer of a session on Markov Processes.

Recent Trends in Stochastic Analysis. In celebration of Martin Barlow's and Edwin Perkins' 60-th birthday, Vancouver July 2013. "SPDE Limits of Many-Server Queues"

PETDS Probability , Ergodic Theory and Dynamical Systems in Memory of Prof Meir Smorodinsky. Tel Aviv University April 9-11, 2014. "The analysis and Control of Many Servers Queueing Systems Using Measure Valued Processes"

PAD Probability Analysis and Dynamics Bristol April 23-25 2014. "Stochastic PDE Limits of Many Servers Queues".

Contributed Papers:

10th Conference on Stochastic Processes and their Applications, Montreal, August 1981: "Regenerative Systems and Markov Additive Processes".

11th Conference on Stochastic Processes and their Applications, Clairmont Ferrand, France, June 1982, "Excursions of Markov Processes via Markov Additive Processes".

16th Conference on Stochastic Processes and their Applications, Stanford University, August 1987: "Random Time Changes for Processes with Random Birth and Death".

20th Conference on Stochastic Processes and their Applications, Nahariya, June 1991: "Multi Armed Bandits Driven by Levy Processes" (joint with Avi Mandelbaum); "Ray Knight Theorems for Symmetric Markov Processes" (joint with Nathalie Eisenbaum).
Speaker: N. Eisenbaum.

21st Conference on Stochastic Processes and their Applications, York University, Toronto, Canada, June 1992: "A Necessary and Sufficient Condition for the Markov Property of the Local Time Process" (joint with Nathalie Eisenbaum).
Speaker: H. Kaspi.

Seminar on Stochastic Processes, Gainesville, Florida, March 1995: "On the Markov Property of Local Times of Markov Processes Taking Values on Graphs".

First Vancouver Meeting on Probability Theory and Its Applications, August 1997: "p-Variation for Families of Local Times on Lines".

Seminar on Stochastic Processes, MSRI, Berkeley, March 1998: "On a Construction for a Solution to a Non Linearly Skewed Brownian Motion".

Fourth Hungarian Colloquium on Limit Theorems of Probability and Statistics, Balatonlelle, Hungary, 28.6.-2.7.1999: "On Variably Skewed Brownian Motion".

Seminar on Stochastic Processes, Gainesville, Florida,, March 2001: "Flows Associated with Skew Brownian Motions".

Seminar on Stochastic Processes, Princeton, N.J. March 2002: "Splitting/Coalescence in Skew Brownian Flows".

Ecole d'ete de Probabilites , St. Flour France, July 2002: "Lenses in Skew Brownian Flows".

Seminar on Stochastic Processes, Seattle, WA, March 2003: "Lenses in Skew Brownian Flows and their Williams-type Decomposition".

34th Conference on Stochastic Processes and their Applications. University of California Santa Barbara, June 2005. " A Characterization of Infinitely Divisible Square Gaussian Processes."

Seminar on Stochastic processes, Cornell March 2005 : " Characterization of Gaussian processes with infinitely divisible square".

35th Conference on Stochastic Processes and Their Applications, Paris, July 2006. "On the Continuity of Local Time of Borel Right processes".

Seminar on Stochastic Proceses(SSP) Riverside Ca March 2011 In honor of Prof. Erhan Cinlar Spoke on Prof Cinlar leadership of SSP since its initiation in 1979.

Applied Probability Society (APS INFORMS) Meeting. Stockholm July 2011. "Optimal Control for Parallel Server Model in Equilibrium of the Fluid Limit Using Measure Valued Processes". Invited talk given by co-author Rami Atar.