

CURRICULUM VITAE (SHORT)

KARL SIGMAN

April 2019

Employment:

Columbia University, Department of Industrial Engineering and Operations Research,
S. W. Mudd Building, 500 West 120th Street, MC: 4704, NY, NY 10027.

- July 1997-present: Professor (tenured 1993)
- July 1991-June 1997: Associate Professor
- July 1987-June 1991: Assistant Professor
- July 1986- July 1987: Postdoctoral Associate, Mathematical Sciences Institute,
Cornell University, Ithaca, New York.

Director of the Center for Applied Probability (CAP)

www.cap.columbia.edu

Director of Undergraduate Programs for the Department of Industrial Engineering and
Operations Research

Education:

University of California at Berkeley, Berkeley, California

- July 1986: Ph.D., Industrial Engineering and Operations Research.
Dissertation Topic: Applications of Harris Ergodic Markov
Chains to Queueing Systems (Dissertation Advisor: Ronald
Wolff)
- May 1984: M.S., Industrial Engineering and Operations Research
- June 1983: M.A., Mathematics

University of California at Santa Cruz, Santa Cruz, California

- January 1980: B.A., Mathematics (Highest Honors)

Prizes and Awards:

- 2002: Distinguished Faculty Teaching Award (SEAS, Columbia University)
- 1998: Distinguished Faculty Teaching Award (SEAS, Columbia University)
- 1989: Presidential Young Investigator Award (NSF, March)
- 1986: George E. Nicholson Prize (First Prize) (Operations Research Society of America)

University of California at Berkeley:

Bernard Friedman Memorial Prize in Applied Mathematics, (Mathematics Department) (1986)

Outstanding Teaching Assistant Award (Department of Industrial Engineering and Operations Research) (1986)

Grants:

IBM Research Faculty Award: January 2003 – December 2003, \$40,000

NSF, 2001-2004, \$300,000: *Asymptotics and Bounds for Stochastic Networks in the Presence of Heavy Tails*

NSF, 1996-2001, \$1000,000: *Center for Applied Probability (CAP): Infrastructure Support for an Interdisciplinary Research Center.* (One of several co-PI's.)

NSF, 1996-1999, \$255,000: *Risk and Duality in Multidimensional Stochastic Recursions*

NSF, January 1995-July, 1995, \$65,000: International Awards Program, *Fluid Flow Approximation in Open Networks* (Sabbatical in Tokyo Japan)

Presidential Young Investigator Award (PVI), NSF, 1989-1994: *Stability, Moments, and Regenerative Simulation of Queueing Networks*

Engineering Research Initiation Award, 1989 (superseded by PVI)

Bellcore, 1990-1992, \$10,000: *Applied Probability in Telecommunications*

Research Interests:

Applied and theoretical aspects of stochastic modeling in:

Queueing theory and communications

Stochastic Simulation; perfect/exact simulation

Heavy-tailed distributions, Insurance risk theory

Financial Engineering, Economics, USA Presidential elections

Stationary marked point processes, high-resolution digital audio

Selection of Publications:

a. Papers published in scholarly journals

Sigman, K., (1988). Regeneration in Tandem Queues with Multi-server Stations, *Journal of Applied Probability*, **25**, 391-403.

Sigman, K., (1988). Queues as Harris Recurrent Markov Chains, *Queueing Systems (QUESTA)*, **3**, 179-198.

Sigman, K., (1989). Notes on the Stability of Closed Queueing Networks, *Journal of Applied Probability*, **26, 3**, 678-682 [Correction: (1990),27,1].

Chao, X., M. Pinedo and K. Sigman, (1989). On the Interchangeability and Stochastic Ordering of Exponential Queues in Tandem with Blocking, *Probability in the Engineering and Informational Sciences (PEIS)*, **3**, 223-236.

Sigman, K., (1990). One-Dependent Regenerative Processes and Queues in Continuous Time, *Mathematics of Operations Research*, **15, 1**, 175-189.

Sigman, K., (1990). The Stability of Open Queueing Networks, *Stochastic Processes And Their Applications*, **35,1**,11-25.

Gelenbe, E., P. Glynn and K. Sigman, (1991). Queues with Negative Arrivals, *Journal of Applied Probability*, **28**, 245-250.

Sigman, K. (1991). A Note On A Sample-Path Rate Conservation Law And Its Relationship With $H = \lambda G$. *Advances In Applied Probability*, **23**, 662-665.

Yamazaki, G., K. Sigman and M. Miyazawa and (1992). Moments in Infinite Channel Queues. *Computers and Mathematics With Applications*, **24**, **1/2**, 1-6.

Browne, S. and K. Sigman (1992) . Work-Modulated Queues With Applications To Storage Processes, *Journal of Applied Probability*, **29**, **3**, 699- 712.

Sigman, K.(1992). Light Traffic For Work-Load In Queues. *Queueing Systems* , Vol. **11**, No. **4**, 429-442.

Sigman, K., and D. Simchi-Levi, (1992). A Light Traffic Heuristic for an M/G/1 Queue with Inventory. *Annals of Operations Research* , **40**, 371-380.

Bardhan, I., and K. Sigman (1993). Rate Conservation Law for Stationary Semimartingales. *Probability in the Engineering and Informational Sciences (PEIS)*, **7**, **1** ,1-17.

Sigman, K. and R. Wolff (1993). A Review of Regenerative Processes. *SIAM Review*, **35**, **2**, 269-288.

Sigman, K. and G. Yamazaki (1993). Heavy And Light Traffic for Fluid Models With Burst Arrivals, *Ann. Inst. Statist. Math.*, **24**, **1/2**, 1-6.

Sigman, K, H. Thorisson and R. W. Wolff (1994). The Existence of Regeneration Times. *Journal of Applied Probability*, **31**, 1116-1122.

K. Sigman and D. Yao, (1994). Finite Moments for Inventory Processes. *Ann. Appl. Prob.*, **4**, **3**, 765-778.

Bardhan, I., and K. Sigman (1994). Stationary Regimes for Inventory Processes. *Stoch. Proc. Appls.*, **56**, 77-86.

Sigman, K. (1996) . Queues under preemptive LIFO and ladder height distributions for risk processes: a duality. *Stochastic Models*, **12**,**4**, 725-736.

Asmussen, S. and K. Sigman (1996). Monotone Stochastic Recursions and their Duals. *Probability in the Engineering and Informational Sciences (PEIS)* , **10**, 1-20.

Jain, G. and K. Sigman (1996). A Pollaczek-Khintchine formulation for queues

O. Boxma, R. Boucherie and K. Sigman (1996). A note on negative customers, GI/GI/1 workload, and risk processes. *Probability in the Engineering and Informational Sciences (PEIS)*, **10**, 305-311.

Jain, G. and K. Sigman (1996). A Pollaczek-Khintchine formulation for M/G/1 queues with disasters. *Journal of Applied Probability*, **33**, 1191-1200.

A. Scheller-Wolf and K. Sigman (1997). Delay moments in GI/GI/s queues. *Queueing Systems (QUESTA)*. **25**, 77-96.

A. Scheller-Wolf and K. Sigman (1998). Moments in tandem queues. *Operations Research*, **46**, 378-380.

Glynn, P. and K. Sigman (1999). Independent Sampling of a Stochastic Process. *Stoch. Proc. Appls.* **74**, 151-164.

Asmussen, S., Kluppelberg, C, and K. Sigman (1999). Sampling at subexponential times, with queueing applications. *Stoch. Proc Appls.* **79**, 265-286.

Huang, T. and K. Sigman (1999). Steady-state asymptotics for tandem, split-match and other feedforward queues with heavy-tailed service. *Queueing Systems*, **33**, 233-260.

K. Sigman (1999). A Primer on heavy-tailed distributions. *Queueing Systems*, **33**, 261-275.

A. Scheller-Wolf and K. Sigman (1998). New Bounds for delay moments in multi-server queues. *Queueing Systems*. **26**, 169-186.

B. Blaszczyszyn and K. Sigman (1999). Risk and Duality in Multidimensions. *Stoch. Proc. Appls.* **83**, 331-356.

R. Ryan and K. Sigman (2000). Continuous time monotone stochastic recursions and duality. *Adv. Appl. Prob.* **32**, 426-445.

- Asymptotic Convergence of Scheduling Policies with respect to Slowdown (2002). Mor Harchol-Balter, K. Sigman and Adam Wierman Performance 2002. IFIP WG 7.3 International Symposium on Computer Modeling, Measurement and Evaluation.
- L. Munasinghe and K. Sigman (2004). A hobo syndrome? Mobility, wages and job turnover. *Labour Economics*, **11**, 191-218.
- P. Shahabuddin, M. Nakayama and K. Sigman (2004). On finite exponential moments for branching processes and busy periods for queues. *J. Appl. Prob*) (*Special Volume 41A* on Stochastic methods and their applications)
- G. Iyengar and K. Sigman (2004). Exponential penalty function based control policies for loss queues Queues. *Ann. Appl. Prob.* **14**, 1698-1740.
- J. Cosyn and K. Sigman (2004). Stochastic networks: admission and routing using penalty functions. *Queueing Systems* **48**, 237-262.
- K. Sigman (2006) Stationary marked point processes. (Contributed invited chapter in *Springer Handbook of Engineering Statistics*, **8**, Springer-Verlag.
- K. Sigman and U. Yechiali (2007) Stationary remaining service time conditional on queue length. *Operations Research Letters* **35**, 581-583.
- M. Harchol Balter, Varun Gupta, K. Sigman and W. Whitt (2007) Analysis of join-the-shortest-queue routing for web server farms. *Performance Eval.* **64** (9-12): 1062-1081.
- K. Sigman (2011). Exact simulation of the stationary distribution of the FIFO M/G/c queue. *Journal of Applied Probability*, **48A**, 209-216.
- J. Blanchet and K. Sigman (2011). On Exact Sampling of Stochastic Perpetuities. *Journal of Applied Probability*, **48A**, 165-182.
- K. Sigman and W. Whitt (2011). Heavy-traffic limits for nearly deterministic queues. *Journal of Applied Probability*, **48**, 657-678.
- K. Sigman and W. Whitt (2011) Heavy-traffic limits for nearly deterministic queues II: Stationary distributions. *Queueing Systems*, **69**, 145-173.

- K. Sigman (2012). Exact simulation of the stationary distribution of the FIFO M/G/c queue: The general case of $\rho < 1$. *Queueing Systems*, **70**, 37-43.
- V. Goyal and K. Sigman (2011) On simulating a class of Bernstein polynomials. *ACM Transactions on Modeling and Computer Simulation (TOMACS)*, **22**, **2**, Article 12.
- Sigman (2013). Using the M/G/1 Queue Under Processor Sharing for Exact Simulation of Queues. *Annals of Operations Research*. June 2013
- Marcus Ang, Karl Sigman, Jing-Sheng Song, Hanqin Zhang (2017). Closed-Form Approximations for Optimal (r,q) and (S,T) Policies in a Parallel Processing Environment. *Operations Research*. *65(5)*, 1414 - 1428.
- Cracking Crypto: An Implied Interest Rate Model for Valuing Cryptocurrency Products
K. Sigman,
Aakanxit Khullar, Dillon Biddiscombe, Alec Silverstein, and Omer Yatkin
Institute of Chartered Accountants in India (ICAI), September 2017, Pages 33--37.
- J. Blanchet, Y. Pei, K. Sigman, "Exact sampling for some multi-dimensional queueing models with renewal input". *Journal of Applied Probability*. (To appear 2019.)
- K. Sigman and W. Whitt (2019). Marked Point Processes in Discrete Time. *Queueing Systems*. (to Appear)
- R. Erikson and K. Sigman. How Biased do the Polls Have to be for Romney to Win? *The Monkey Cage*, November 5, 2012.
<http://themonkeycage.org/2012/11/05/how-biased-do-the-polls-need-to-be-for-romney-to-win>}}
- K. Sigman. Columbia University Probability Professor: These Simple Calculations Are Probably Going to Ruin Romney's Evening. *Business Insider*, November 5, 2012.
<http://www.businessinsider.com/romney-will-lose-according-to-columbia-university-probability-professor-2012-11>}}

e. Books/Special volumes

K. Sigman, (1995). *Stationary Marked Point Processes: An Intuitive Approach* Chapman and Hall, New York

P. Glasserman, K. Sigman and D. Yao (Editors) (1996). *Stochastic Networks: Stability and Rare Events*. Springer Lecture Notes in Statistics 117, Springer-Verlag, New York.

K. Sigman (1999) (Guest Editor). *Special Volume on Queues with Heavy-tailed Distribution*, Queueing Systems, **33**.

Ph.D. Students:

Jacob Bergquist

Past:

Indrajit Bardham (*General Rate Conservation Law With Applications to Diffusion Approximations for Queues*). May 1992.

Gautam Jain (*A Rate Conservation Analysis of Generalized Queues and networks*), May 1996.

Alan Scheller-Wolf (*Finite Moment Conditions for Stationary Content Processes with Applications to Fluid Models and Queues*), May 1996.

Yongfeng Xi (*Queues with Vacations and Exceptional First Arrivals*), May 1996.

Rajesh Sah (*Queues with Correlated Service Times with Applications to Inventory Models*), May 1997.

Tao Huang (*Tail asymptotics for feedforward queueing networks with heavy tailed distributions*), January, 1999

Jan Cosyn, (*Queueing networks and control using penalty functions*), May 2003.