Stephan Bohacek

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Citizenship: US

Experience:
2002-present: Assistant Professor of Electrical and Computer Engineering at the University of Delaware. Joint appointment with Department of Computer Information Sciences.

1999-2002: Assistant Professor (non-tenure track) of Applied Mathematics at University of Southern California.

1999: Ph.D. University of Southern California in Electrical Engineering
Thesis title: Control of Systems with Complicated Dynamics.

1989-1996: DSP Design Engineer. Wadia Digital and Theta Digital.

1989: BSEE Electrical Engineering and Computer Science, University of California, Berkeley.

Teaching and Educational Experience:
Fall 2006: Network Optimization and Modeling (graduate) (

Spring 2005, 2006, 2007: Sensor and Mesh Networking (grad/undergrad lab oriented class)

Fall 2005: Routing in Wireless Networks (graduate)

Fall 2004: Topics in Computer Networks – Transport (graduate)

Spring 2003: Topics in Computer Networks – Routing (graduate)

Fall 2003: Queuing Theory (graduate)

Spring 2003: Topics in Computer Networks (graduate)

Fall 2002, 2003, 2004, 2005, 2006: Introduction to Computer Networks (undergraduate)

McNair Scholars' Mentor of the Year, 2005.

1999-2002: Calculus for Engineers (one year course), Numerical Analysis and Computation (one semester graduate course), Numerical Methods (one semester undergraduate course). These classes have had a significant increase in enrollment since I began teaching them.

2001: A Faculty Fellow for the Office for Residential and Greek Life.

2001: Advisor for the USC Quiz Bowl club.

1998-1999: Teaching Assistant for Mathematics of Physics and Engineering II. Developed a project modeling the heart as a reaction diffusion system and modeling plucked guitar strings.

1997: Teaching Assistant for a graduate class in Linear Systems.

Grants:

7/1/2004 - 9/31/2009: Component-based routing and Software Engineering for MANET Protocols, PI. Award since 9/2004: $343,873. Current annual award: $126,000. Current award for project: $651,000. This research project has six research institutes and ten researchers.

1/15/2006: Network monitoring equipment donation, Nevis Networks, $61K.

9/15/2005 – 8/31/2007: A Hybrid Systems Framework for Scalable Analysis and Design of Communication Networks, $52,530. NSF – Networking Research

9/1/2003 – 8/31/2006: A Hybrid Systems Framework for Scalable Analysis and Design of Communication Networks, $180,000. NSF – Networking Research

6/1/2003-5/31/2005: Realistic modeling of urban wireless networks, $30,000. UDRF

November 16-19, 2000: Co-PI and co-organizer of The Southwest Regional Dynamics Workshop held at USC. $30K from NSF and USC.

7/1/2000 - 6/30/2002: Co-PI, DARPA-AIA program. $1,549,831. Title: Advanced Mathematical Control and Identification Techniques for Autonomic Information Assurance. Under this grant we study mathematical techniques for defending against computer attacks.

1997-1999: Chiropractic Research Grant. Analyzing EMG signals from chiropractic patients during application of Network Spinal Analysis. During this treatment, patients' muscles spontaneously convulse. We performed various techniques to determine the linear/nonlinear process driving this muscle activity.

Affiliations:
IEEE, ACM.

Industrial Experience:
1989-1996: DSP/Software/Hardware engineer for high-end audio manufacturers Theta Digital (Agoura Hills, CA) and Wadia Digital (River Falls, Wisconsin). Developed technically advanced but highly user-friendly automatic equalization system for high-end audio. Designed and implemented signal processing algorithms, measurement and analysis

system, GUI and supporting hardware and software as well as conferred with marketing personnel.

Published Manuscripts:
Journals and Book Chapters

Jonghyun Kim, Vinay Sridhara, and Stephan Bohacek. Realistic Mobility Simulation of Urban Mesh Network. Submitted, 2007.

Peng Wang and Stephan Bohacek. Capacity Optimization of Mesh Networks. Submitted 2007.

Ivan D. Barrera, Stephan Bohacek, and Gonzalo Arce. Statistical Detection of Congestion in Routers. IEEE/ACM Transactions on Networking. Submitted 2007.

Stephan Bohacek. Performance Improvements Provided by Route Diversity in Multihop Wireless Networks. *IEEE Transaction on Mobile Computing*. To appear.

Junsoo Lee, Stephan Bohacek, João P. Hespanha, and Katia Obraczka. Modeling Communication Networks with Hybrid Systems. *IEEE/ACM Transactions on Networking*. To appear October 2007.

Chansook Lim, Stephan Bohacek, João P. Hespanha, Junsoo Lee, and Katia Obraczka. Game Theoretic Stochastic Routing for Fault Tolerance on Computer Networks, *IEEE Transactions on Parallel and Distributed Systems*. To appear 2007.

Vinay Sridhara and Stephan Bohacek. Realistic Propagation Simulation of Urban Mesh Networks. *The International Journal of Computer and Telecommunications Networking Computer Networks and ISDN Systems* (*COMNET*). Volume 51, Issue 12, Pages 3392-3412, 2007.

Stephan Bohacek. On Maximizing Capacity in Fixed Mesh Networks with MIMO Links. In *Handbook of Wireless Mesh Networking*. McGraw-Hill International: NY. 2007 (invited book chapter).

Wang Peng and Stephan Bohacek. The Practical Performance of Subgradient Computational Techniques for Mesh Network Utility Optimization. In *Lecture Notes in Computer Science* (*LNCS*), 2007.

Khushboo Shah, Edmond Jonckheere, and Stephan Bohacek. Dynamic Modeling of Internet Traffic for Intrusion Detection. *EURASIP Journal on Applied Signal Processing*. 2007.

Stephan Bohacek, João P. Hespanha, Junsoo Lee, Chansook Lim, and Katia Obraczka. TCP-PR: TCP for Persistent Packet Reordering. *IEEE/ACM Transactions on Networking.* Vol. 14, no. 2, April 2006.

Jonghyun Kim and Stephan Bohacek. Selection metrics for multihop cooperative relaying. In *Challenges in Ad Hoc Networking: Fourth Annual Mediterranean Ad Hoc Networking Workshop, June 21-24, 2005, Île de Porquerolles, France.* Springer-Verlag, Berlin, 2005.

Stephan Bohacek, Khushboo Shah, Gonzalo R. Arce, and Mike Davis. Signal Processing Challenges in Active Queue Management. *IEEE Signal Processing Magazine*, 2004.

Bohacek, Stephan. Email Worm Propagation on Random Graphs. In *Computing Science and Statistics*, 35, 2003.

Stephan Bohacek and Boris Rozovskii. A Diffusion Model of Roundtrip Time. *Journal of Computational Statistics and Data Analysis*, 2003.

Stephan Bohacek and Edmond Jonckheere. Relationships Between Linear Dynamically Varying Systems and Jump Linear Systems. *Mathematics of Control, Signals, and Systems (MCSS)*. Springer: London. 2003.

João Hespanha, Stephan Bohacek, Katia Obraczka, Junsoo Lee. Hybrid Modeling of TCP Congestion Control. In Maria Domenica Di Benedetto, Alberto Sangiovanni-Vincentelli, *Hybrid Systems: Computation and Control*, number 2034 in Lecture Notes in Computer Science, pages 291—304, Mar. 2001.

Stephan Bohacek and Edmond Jonckheere. Linear Dynamically Varying LQ Control of Nonlinear Systems over Compact Sets. *IEEE Transactions on Automatic Control.* June 2001.

Stephan Bohacek and Edmond Jonckheere. Nonlinear Tracking over Compact Sets with Linear Dynamically Varying H-infinity. *SIAM J. Control and Optimization.* 2001.

Stephan Bohacek and Edmond Jonckheere. Structural Stability of Linear Dynamically Varying (LDV) Controllers. *System and Control Letters.* 2001.

Stephan Bohacek and Edmond Jonckheere. Nonlinear Modeling in Network Spinal Analysis: Preliminary Report: Nonlinear Canonical Correlation with Alternating Conditional Expectation (ACE). *The Journal of Vertebral Subluxation Research.* 1999.

Edmond Jonckheere, Poonsuk Lohsoonthorn, and Stephan Bohacek. Propulsion Control. *Recent Advances in Control Theory.* Elsevier: Amsterdam. 1999.

Reviewed Conference Papers

Vinay Sridhara, Hwee-Chul Shin and Stephan Bohacek. Performance of 802.11b/g in the Interference Limited Regime. In *Proc. of the First International Workshop on Wireless Mesh and Ad Hoc Networks (WiMAN)*. 2007.

Jonghyun Kim and Stephan Bohacek. A Comparison of Opportunistic and Deterministic Forwarding in Mobile Multihop Wireless Networks. In *Proc. of the 1st International MobiSys Workshop on Mobile Opportunistic Networking (MOBIOPP)*, 2007.

Peng Wang and Stephan Bohacek. Capacity Optimization in Wireless Mesh Networks. In *Proc. of the Ninth Annual Workshop on MAthematical Performance Modeling and Analysis (MAMA),* 2007.

Stephan Bohacek and Peng Wang. Toward tractable computation of the capacity of multihop wireless networks. In the *Proc. of the 26th Annual IEEE Conference on Computer Communications* (*INFOCOM*). 2007.

Wang Peng and Stephan Bohacek. The Practical Performance of Subgradient Computational Techniques for Mesh Network Utility Optimization. In *Proc. of the International Conference on Network Control and Optimization* (*Net-Coop*). 2007.

Kejing Liu, Stephan Bohacek, and Javier Garcia-Frias. Interference Mitigating in Wireless Networks Using Prior Knowledge. In *Proc. Conference on Information Sciences and Systems* (*CISS*), 2007.

Stephan Bohacek, Vinay Sridhara, and Lei Luo. Efficient Paging Mechanisms for LUMNets, In *Proc. of the Fourth ACM International Workshop on Wireless Mobile Applications and Services on WLAN Hotspots (WMASH)*. 2006.

Vinay Sridhara, Hwee-Chul Shin and Stephan Bohacek. Observations and Models of Time-Varying Channel Gain in Crowded Areas. In *Proc. of the Second International Workshop on Wireless Traffic Measurements and Modeling* (*WiTMeMo*). 2006.

Stephan Bohacek. Achievable Performance Improvements Provided by Cooperative Diversity. In *Proc. of the 4th Intl. Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOPT)*, 2006.

Jonghyun Kim and Stephan Bohacek. Exploiting multihop diversity through efficient localized searching with CDMA and route metric-based power control. In *Proc. of the 7-th ACM/IEEE International Symposium on Modeling, Analysis and Simulation of Wireless and Mobile Systems (MSWiM)*, 2006.

Stephan Bohacek, Andjela Ilic, and Vinay Sridhara. On the Predictability of Link Lifetimes in Urban MANETs. In *Proc 4th Intl. Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOPT)*. 2005.

Stephan Bohacek, Rick Blum, Len Cimini, Larry Greenstein, and Alex Haimovich. The Impact of the Timeliness of Information on the Performance of Multihop Best-Select. In *Proc. of the Military Communication Conference (MILCOM)*. 2005.

Chansook Lim, Stephan Bohacek, Joao P. Hespanha, and Katia Obraczka. Hierarchical Max-Flow Routing. In *Proc. of the 48th annual IEEE Global Telecommunications Conference (GLOBECOM)*, 2005.

Vinay Sridhara, Jonghyun Kim, and Stephan Bohacek. Models and Methodologies for Simulating Mobile Ad- Hoc Networks. In *Proc. of the 3rd IEEE International Workshop on Mobility Management and Wireless Access (MOBIWAC)*. 2005.

Jonghyun Kim and Stephan Bohacek. A Survey-Based Mobility Model of People for Simulation of Urban Mesh Networks. In *Proc. of MeshNets2005*, 2005

V. Sridhara, J. Kim, and S. Bohacek. Performance of Urban Mesh Networks. In *Proc. of the 8-th ACM/IEEE International Symposium on Modeling, Analysis and Simulation of Wireless and Mobile Systems (MSWiM)*. 2005.

Khushboo Shah, Stephan Bohacek: High short-term bit-rates from TCP Flows. In *Proc. of the 13th Annual Meeting of the IEEE International Symposium on Modeling, Analysis, and Simulation of Computer and Telecommunication Systems (MASCOTS).* 2005.

Stephan Bohacek and Vinay Sridhara. The Graphical Properties of MANETs in Urban Environments. In *Proc. of the 42nd Annual Allerton Conference on Communication, Control, and Computing.* 2004.

Stephan Bohacek and Khushboo Shah. TCP throughput and timeout -- steady state and time-varying dynamics. In *Proc. of the 47th annual IEEE Global Telecommunications Conference (GLOBECOM).* 2004.

Khushboo Shah, Stephan Bohacek and Edmond Jonckheere. Limitation on achievable performance of active queue management. In *Proc. of the IEEE Conference on Decision and Control (CDC).* 2004.

Khushboo Shah and Stephan Bohacek. Feasibility of Detecting TCP-SYN Scanning at a Backbone router. In *Proc. of the American Control Conference (ACC).* 2004.

Khushboo Shah and Stephan Bohacek. On the tail of the arrival process. *IT-COM.* 2004.

Stephan Bohacek. A Stochastic Model of TCP and Fair Video Transmission. *In the Proc. of the 22th Annual IEEE Conference on Computer Communications (INFOCOM). 2003.*

Stephan Bohacek, João Hespanha, Katia Obraczka and Junsoo Lee. A Hybrid Systems Modeling Framework for Fast and Accurate Simulation of Data Communication Networks. In *Proc. of the International Conference on Measurement and Modeling of Computer Systems* (*ACM SIGMETRICS*). 2003.

Stephan Bohacek, João Hespanha, Katia Obraczka and Junsoo Lee. TCP-PR: TCP for Persistent Packet Reordering. *The 26th International Conference on Distributed Computing Systems* (*ICDCS*). 2003.

F. Ariaei, E. Jonckheere, S. Bohacek. "Tracking Trojan Asteroids in Periodic and Quasi-Periodic Orbits around the Jupiter Lagrange Points Using LDV Techniques," International Conference PhysCon. 2003

Khushboo Shah, Stephan Bohacek and Edmond Jonckheere. On the Predictability of Data Network Traffic. In *Proc. of the American Control Conference (ACC).* 2003.

E. Jonckheere, K. Shah and S. Bohacek. Dynamic Modeling of Internet Traffic for Intrusion Detection. *In Proc of the American Control Conference (ACC).* 2002.

Stephan Bohacek. Fair Pricing of Video Transmissions Using Best-Effort and Purchased Bandwidth. In *Proc of the 40th Annual Allerton Conference on Communication, Control, and Computing*. 2002.

Stephan Bohacek. Optimal Filtering for Denial of Service Mitigation. In *Proc. of the 41st IEEE Conference and Decision and Control* (ACC). 2002.

Stephan Bohacek, João Hespanha, and Katia Obraczka. Saddle Policies for Secure Routing in Communication Network. In *Proc. of the 41st IEEE Conference and Decision and Control (CDC)*. 2002. (invited paper)

Stephan Bohacek, Joao Hespanha, Katia Obraczka, Junsoo Lee and Chansook Lim. Secure Stochastic Routing. In *Proc. of the 11th International Conference on Computer Communications and Networks (ICCCN).* 2002.

Edmond Jonckheere, Khushboo Shah, and Stephan Bohacek. Time Series Modeling of Internet Traffic for Intrusion Detection. In *Proc. of the American Conference on Control (ACC)*. 2002.

João Hespanha, Stephan Bohacek, Katia Obraczka, and Junsool Lee. Hybrid System Modeling of TCP Congestion Control. In *Proc. of the 39th Annual Allerton Conference on Communication, Control and Computing*. 2001 (invited paper).

Stephan Bohacek and Boris Rozovsky. Network Tomography. In *Proc. of the IEEE Systems, Man, and Cybernetics Information Assurance Workshop,* 2001.

João Hespanha and Stephan Bohacek. Preliminary Results in Routing Games. In *Proc. of the American Conference on Control (ACC).* 2001.

Stephan Bohacek, João Hespanha, Katia Obraczka, and Junsoo Lee. Hybrid Modeling of TCP Congestion Control. *Proceedings of the Maria Domenica Di Benedetto and Alberto Sangiovanni-Vincentelli, Hybrid Systems: Computation and Control.* March 2001.

Stephan Bohacek. Stability of Hop-by-Hop Congestion Control. In *Proceedings of the Conference on Decision and Control (CDC).* 2000.

Stephan Bohacek and Edmond Jonckheere. Linear Quadratic Control of Chaotic Systems with LDV Controllers. In *Proceedings of the CCOC*. 2000.

Stephan Bohacek and Edmond Jonckheere. Analysis and Synthesis for Linear Set-Valued Dynamically Varying System. In *Proc. of the American Control Conference (CDC)*. 2001.

Stephan Bohacek and Edmond Jonckheere. Linear Dynamically Varying Systems versus Jump Linear Systems. In *Proceedings of the American Control Conference (ACC)*. 1999.

Vishwesh Kulkarni, Stephan Bohacek, and Michael Safonov. Robustness of interconnected systems with actuator saturation and time delays. In *Proc. of the American Conference on Control (ACC).* 1999.

Stephan Bohacek and Edmond Jonckheere. Structural Stability of Linear Dynamically Varying Control. In *Proceedings of the Conference on Decision and Control (CDC)*. 1998.

Vishwesh Kulkarni, Stephan Bohacek, and Michael Safonov. Stability Issues in Hop-by-Hop Based Congestion Control. *Proceedings of the 36th Allerton Conference on Communication, Control and Computing.* 1998.

Stephan Bohacek and Edmond Jonckheere. Linear Dynamically Varying H-infinity Control of Chaos. *Proceedings of the IFAC Nonlinear Control Systems Design Symposium.*1998 (invited paper).

Tutorials:

Stephan Bohacek and Vinay Sridhara. Realistic Simulation of Urban Mesh Networks with the UDelModels Simulators," in conjunction with *The 10-th ACM/IEEE International Symposium on Modeling, Analysis and Simulation of Wireless and Mobile Systems (MWSiM)*, 2007.

Software Developed:

Stephan Bohacek, Vinay Sridhara, and Jonghyun Kim. UDelModels: For Simulation of Urban Mobile Wireless Networks. Available at http://UDelModels.eecis.udel.edu. Released in July 2006. As of July 2007, there are 130 registered users. See http://udelmodels.eecis.udel.edu/webstat for some web statistics.

Chansook Lim, Junsoo Lee, Stephan Bohacek, João P. Hespanha, Katia Obraczka. ns-2 code for TCP-PR (available at http://www.eecis.udel.edu/~bohacek/TCP-PR/TCP-PR.html)

Invited Talks:

"Capacity Maximization in Urban Mesh Networks," INRIA Sophia Antipolis, 2007.

"Capacity Maximization in Urban Mesh Networks," QualComm, 2007.

"Capacity Maximization in Urban Mesh Networks," University of California Santa Barbara , 2007.

"Realistic Simulation of Urban Wireless Networks," INRIA Sophia Antipolis, 2006.

"Multihop Cooperative Networking for Mobile Wireless Networking," Lehigh, March 2, 2005.

"Worm and Virus Propagation over the Internet," The Mathematics of Networks Network Colloquium Series, University of Delaware, 2005.

"Worm Propagation on Graphs with Heavy-tailed Degree Distribution," The Advanced Network Colloquium Series at The University of Maryland, 2003.

"Stochastic Models of TCP," The Advanced Network Colloquium Series at The University of Maryland, 2003.

"Control Theory and the Information Assurance of Computer Network," Control-Theoretic Approaches for Dynamic Information Assurance, Berkeley, 2003.

"Worm Propagation over Graphs," Workshop on Statistical and Machine Learning Techniques in Computer Intrusion Detection, to be held June 11-13, 2002 at Johns Hopkins University.

"A Stochastic Model of TCP and Fair Video Transmission," May 17, 2002, Applied Mathematics Seminar, Stanford University

"Filtering and Prediction in Computer Networks," 2nd Southern California Applied Mathematics, to be held May 4, 2002

"The Dynamics of TCP," Los Angeles Dynamics Seminar. October 2001.

"Estimating Congestion in TCP Traffic," in session "Stochastic Theory and Applications" for the Fifth SIAM Conference on Control and its Applications. San Diego, August 2001.

"Worm Propagation and Robust Routing," DARPA FTN PI Meeting, August 2001.

"Some Internet Dynamics and Alternatives to TCP Friendly Congestion Control", Control and Dynamical Systems at Caltech, May 2001.

"DoS Detection and Mitigation," DARPA SWIMM PI Meeting, February 2001.

"A Deeper Look at LPV," SoCal Nonlinear Control Workshop, October 2000.

"Hop-by-hop flow control in data networks", British Telecom, June 1999.

Reviewer:
   Journals:
   IEEE Transactions on Automatic Control
   IEEE Transactions on Signal Processing
   Journal of Ad Hoc Networks
   The International Journal of Computer and Telecommunications Networking (Computer Networks)
   Journal of Systems and Software
   IEEE Transactions on Parallel and Distributed Systems
   IEEE/ACM Transactions on Networking
   IEEE Transactions on Systems, Man, and Cybernetics
   IEEE Communications Letters
   Computational Statistics & Data Analysis
   Conferences:
   IEEE International Conference on Communications (ICC) (Reviewer and Program Committee)
   IEEE Global Telecommunications Conference (GLOBECOM)
   IEEE Annual Conference on Computer Communications (INFOCOM)
   The Annual Military Communication Conference (MILCOM).
   International Conference on Mobile Ad-hoc and Sensor Systems (MASS)
   ACM SIGCOMM

Past Students:
   Junsoo Lee. Tenure track at Sookmyung Women's University, in Soel Korea. Co-advised with João Hespanha (UCSB), Katia Obraczka (UCSC). Graduated with Ph.D. from USC in 2004.

   Chansook Lim. Tenure track at Hongik University, Korea. Co-advised with João Hespanha (UCSB), Katia Obraczka (UCSC).Graduated with Ph.D. from USC in 2006. Post-doc at University of Delaware, 2006-2007.

Vinay Sridhara. Qualcomm Research. Graduated with Ph.D. in May 2007.

Andjela Ilic. Ortiva Wireless. Graduated with M.S. in 2006.

Andres Mancera. Juniper Networks. Graduated with M.S. in 2006.

Gaurav Singh. Sun Microsystems. Graduated with M.S. in 2004.

Markus Kloos. Graduated with M.S. in 2005.

Javier Ascarrunz. Graduated with M.S. in 2004.