

Prashant G. Mehta

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Research Interests

Dynamical Systems and Control theory: Development of stochastic methods for representation, analysis, control and design of complex dynamic behavior, and Network applications including building systems, communication networks, and jet engines.

Education

B.E., Electrical and Electronics Engineering, Birla Institute of Technology & Sciences, Pilani, India, 1993

M.S., Electrical and Computer Engineering, University of Massachusetts, Amherst, MA, 1996

Ph.D. Mathematics, Cornell University, Ithaca, NY, 2004

Professional Experience

Assistant Professor, Department of Mechanical Science and Engineering, UIUC, Sept. 2005-date

Research Assistant Professor, Coordinated Science Laboratory, UIUC, Jan 2007-date

Research Engineer, United Technologies Research Center, East Hartford, CT, 1996-98, 2001-05

Honors and Awards

Excellence in Undergraduate Advising Award, College of Engineering, University of Illinois, 2008

Advisor on Best Student Paper Award, IEEE Conference of Decision and Control, 2007

Outstanding Achievement Award, United Technologies Research Center, East Hartford, CT, 2005

NSF IGERT Fellowship, Cornell University, 2001

Outstanding Teaching Assistant Award, Department of Electrical and Computer Engineering,
University of Massachusetts, Amherst, 1994

Journal Publications

1. Sun Y. and P. G. Mehta, "Fundamental Performance Limitations via Entropy Estimates with Hidden Markov Models," conditionally accepted to the *IEEE Transactions on Automatic Control*.
2. Sun Y. and P. G. Mehta, "The Kullback-Leibler Rate Metric for Comparing Dynamical Systems," conditionally accepted to the *IEEE Transactions on Automatic Control*.
3. Yin, H., P. P. Wang, T. Alpcan, and P. G. Mehta, "Hopf Bifurcation in Communication Networks with Heterogeneous Delays," To appear in the *Automatica*, 2010.
4. Vaidya, U., P. G. Mehta and U. Shanbhag, "Nonlinear Stabilization via Control Lyapunov Measure," To appear in the *IEEE Transactions on Automatic Control*, 2010.
5. Barooah, P., P. G. Mehta and J. Hespanha, "Mistuning-based Control Design to Improve Closed-loop Stability of Vehicular Platoons," To appear in *IEEE Transactions on Automatic Control*, 2009.
6. Mehta, P. G., "Controlling Combustion," *IEEE Control Systems Magazine*, June 2009.

7. Alpcan, T., P. Wang, P. G. Mehta and T. Basar, "A Non-equilibrium Analysis and Control Framework for Active Queue Management," *Automatica*, 44:10, 2474-2486, October 2008
8. Mehta, P. G., U. Vaidya, and A. Banaszuk, "Markov chains, Entropy and Fundamental Limitations in Nonlinear Stabilization," *IEEE Transactions on Automatic Control*, 53:3, 784-791, April 2008
9. Mehta, P. G., G. Hagen, and A. Banaszuk, "Symmetry and Symmetry-breaking for a Wave Equation with Feedback," *SIAM Journal of Applied Dynamical Systems*, 6:3, 549-75, July 2007
10. Vaidya, U. and P. G. Mehta, "Lyapunov Measure for Almost Everywhere Stability," *IEEE Transactions on Automatic Control*, 53:1, 307-324, March 2008
11. Mehta, P. G., B. A. Eisenhower, and J. Ooppelstrup, "Computational Modeling and Analysis of Multiple Steady-States in Vapor Compression Systems," *ASME Journal of Computational and Nonlinear Dynamic*, 2:2, 132-40, April 2007.
12. Banaszuk, A., P. G. Mehta, and G. Hagen, "The Role of Control in Design: From Fixing Problems to Design of Dynamics." *Control Engineering Practice*, 15:10, 1292-1305, October 2007.
13. Mehta, P. G., M. Hessel, and M. Dellnitz, "Symmetry of Attractors and the Perron-Frobenius Operator," *Journal of Difference Equations and Applications*, 12(11), 1147-78, Nov. 2006
14. Banaszuk, A., P. G. Mehta, C. A. Jacobson, and A. I. Khibnik, "Limits of Achievable Performance of Controlled Combustion Processes," *IEEE Trans. on Control Systems Technology*, 14(5), 881-95, Sep. 2006.
15. Mehta, P. G., G. Hagen, and A. Banaszuk, "Dynamical Systems in Jet Engines: A Symmetry Based Approach," *Dynamical Systems Magazine (DS Web)*, Society of Industrial and Applied Mathematics, Oct. 2005 (Invited).
16. Mehta, P. G. and T. J. Healey, "On Steady Solutions of Symmetry Preserving Perturbations of the 2D Couette Flow Problem," *Physics of Fluids*, 17:10, October 2005.
17. Healey, T. J. and P. G. Mehta, "Straightforward Computations of Spatial Equilibria of Geometrically Exact Cosserat Rods," *International Journal of Bifurcation & Chaos*, 15:3, 949-965, March 2005.
18. Mehta, P. G., M. C. Soteriou, and A. Banaszuk, "Impact of Exothermicity on Steady and Linearized Response of Premixed Ducted Flame," *Combustion & Flame*, 141:4, 392-405, June 2005.
19. Mehta, P. G., "A Unified Well-posed Computational Approach to the 2D Orr-Sommerfeld Problem," *Journal of Computations Physics*, 199:2, 541-557, Sept 2004.

U.S. Patents

1. Hagen, G., A. Banaszuk, P. G. Mehta, J. M. Cohen, and W. Proscia, "Adaptive Spatial Fuel Distribution Method for Control of Thermoacoustic Instabilities in Annular Combustors and Augmentors," UTRC, 2007.

Conference Publications

1. Deng, K., P. G. Mehta, and S. P. Meyn, "An Information-Theoretic Framework to Aggregate a Markov Chain," To appear in the *American Control Conference*, St. Louis, June 2008.
2. Yin, H., C. L. Cox, P. G. Mehta and U. Shanbhag, "Bifurcation Analysis of a Thalamic Relay Neuron Model," To appear in the *American Control Conference*, St. Louis, June 2008.
3. Deng, K., W. Chen, P. G. Mehta and S. P. Meyn. Resource Pooling for Optimal Evacuation of a Building. *Proceedings of Conference of Decision and Control*, Cancun, pp. 5565-70, December, 2008.
4. Nieblaski, J., K. Deng, P. G. Mehta and S. P. Meyn. Model Reduction for Reduced Order Estimation in Traffic Models. *Proceedings of American Control Conference*, Seattle, pp. 914-19, June 2008.
5. Sun Y., P. G. Mehta and S. P. Meyn. Belief Propagation in Feedback Systems: Connections to Bode and Observability. *Proceedings of American Control Conference*, Seattle, pp. 1268-73, June 2008.
6. Yin, H., P. Wang, T. Alpcan and P. G. Mehta, "Hopf Bifurcation and Oscillations in Communication Networks with Delays" *Proceedings of International Federation of Control (IFAC) World Congress*, Seoul, Korea, July 2008.
7. Sun Y. and P. G. Mehta, "Fundamental Performance Limitations via Entropy Estimates with Hidden Markov Models," *Proceedings of Conference on Decision & Control*, New Orleans, pp. 3982 - 3988 Dec. 2007.
8. Vaidya, U., P. G. Mehta and U. Shanbhag, "Nonlinear Stabilization via Control Lyapunov Measure," *Proceedings of Conference on Decision & Control*, New Orleans, pp. 1722 - 1727, Dec. 2007.
9. T. Alpcan, P. Wang, P. G. Mehta, and T. Basar, "A Non-equilibrium Analysis and Control Framework for Active Queue Management," *Proceedings of the Nonlinear Control Conference*, South Africa, 2007.
10. Barooah, P., P. G. Mehta, and J. Hespanha, "Control of Large Vehicular Platoons: Improving Closed Loop Stability by Mistuning," *Proceedings of American Control Conference*, New York, pp. 4666-4671, July 2007.
11. Niedbalski, J. and P. G. Mehta, "Simulation and Estimation of Traffic Dynamics on a Graph," *Proceedings of American Control Conference*, New York, pp. 5064-5069, July 2007.
12. Mehta, P. G., U. Vaidya, and A. Banaszuk, "Markov Chains, Entropy, and Fundamental Limitations in Nonlinear Stabilization," *Proceedings of Conference on Decision & Control*, San Diego, pp. 5222-27, Dec. 2006
13. Alpcan, T., P. G. Mehta, T. Basar, and U. Vaidya, "Control of Non-equilibrium Dynamics in Communication Networks," *Proceedings of Conference on Decision & Control*, San Diego, pp. 5216-21, Dec. 2006

14. Vaidya, U. and P. G. Mehta, "Computation of Lyapunov measure for Almost Everywhere Stability." *Proceedings of Conference on Decision & Control*, San Diego, pp. 5228-33, Dec. 2006
15. Mehta, P. G., M. Dorobantu, and A. Banaszuk, "Graph-based Multi-scale Analysis of Building Systems Transport Models," *Proceedings of American Control Conference*, Minneapolis, pp. 1110-15, July 2000
16. Li, F., G. Tadmor, A. Banaszuk, B. R. Noack, and P. G. Mehta, "A Reduced Order Galerkin Model for the Reacting Flame Holder," *Third AIAA Flow Control Conference*, San Francisco, CA, AIAA Paper 2006-3487, June 5-8, 2006.
17. Banaszuk, A., P. G. Mehta, and G. Hagen, "The Role of Control in Design: From Fixing Problems to the Design of Dynamics," *Proceedings of the International Symposium on Advanced Control of Chemical Processes*, Gramado, Brazil, April 2006 (Invited article for the keynote talk).
18. Erickson, R. R., M. C. Soteriou, and P. G. Mehta, "The Influence of Temperature Ratio on the Dynamics of Bluff Body Stabilized Flames," *Proceedings of the 44th AIAA Aerospace Sciences Meeting and Exhibit*, Reno, NV, AIAA-2006-0753, Jan. 2006.
19. Mehta, P. G. and U. Vaidya, "On Stochastic Analysis Approaches for Comparing Complex Systems," *Proceedings of the IEEE Conference on Decision and Control*, Seville, Spain, 8082-8087, Dec. 2005.
20. Banaszuk, A., P. G. Mehta and I. Mezic, "Spectral Balance: a Frequency Domain Framework for Analysis of Nonlinear Dynamical Systems," *Proceedings of the 43rd Conference on Decision and Control*, Paradise Island, Bahamas, Vol.2, 2244-2249, Dec. 2004.
21. Mehta, P. G., A. Banaszuk, and M. C. Soteriou, "Impact of Convection and Diffusion Processes in Fundamental Limitations of Combustion Control," *Proceedings of the 2nd AIAA Flow Control Conference*, Portland, OR, AIAA No. 2004-2410, Jun. 2004.
22. Mehta, P. G., A. Banaszuk, and M. C. Soteriou, "Distributed Control-oriented Modeling of Thermoacoustic Dynamics in a Duct," *Proceedings of the American Control Conference*, Boston, MA, Vol. 6, 5692-5697, Jun. 2004.
23. Hagen, G. and P. G. Mehta, "On Steady Solutions of a PDE Model of Compressor Stall," *Proceedings of the 42nd IEEE Conference on Decision and Control*, Maui, Hawaii, Vol. 2, 1848-1853, Dec. 2003.
24. Banaszuk, A., P. G. Mehta, G. Hagen and J. Ooppelstrup, "A Linear Model for Control of Thermoacoustic Instabilities on Annular Domain," *Proceedings of the 42nd Conference on Decision and Control*, Maui, Hawaii, Vol. 3, 2346-2351, Dec. 9-12, 2003.
25. Mehta, P. G., A. Banaszuk, M. C. Soteriou, and I. Mezic, "Fuel Control of a Ducted Bluffbody Flame," *Proceedings of the 42nd Conference on Decision and Control*, Maui, Hawaii, Vol. 3, 2340-2345, Dec. 2003.
26. Mehta, P. G. and M. C. Soteriou, "Combustion Heat Release Effects on the Dynamics of Bluff Body Stabilized Premixed Reacting Flows," *Proceedings of the 41st AIAA Aerospace Sciences Meeting and Exhibit*, Reno, NV, 2003-0835, Jan. 2003.

27. Mehta, P. G., A. Banaszuk, and C. A. Jacobson, "Framework for Studying Limitations of Achievable Performance in Control of Nonlinear Combustion Processes," *Proceedings of the International Federation of Automatic Control World Congress*, Barcelona, Jun. 2002.
28. Mehta, P. G. and A. Banaszuk, "On the Identification of a Nonlinear Function in Feedback Loop," *Proceedings of the Conference on Decision and Control*, Orlando, FL, Vol. 5, 4320-4325, Dec. 2001.
29. Banaszuk, A., C. A. Jacobson, A. I. Khibnik, and P. G. Mehta, "Linear and Nonlinear Analysis of Controlled Combustion Processes, Part I: Linear Analysis," *Proceedings of the IEEE International Conference on Control Applications*, Hawaii, Vol. 1, 199-205, Aug. 1999.
30. Banaszuk, A., C. A. Jacobson, A. I. Khibnik, and P. G. Mehta, "Linear and Nonlinear Analysis of Controlled Combustion Processes, Part II: NonLinear Analysis," *Proceedings of the IEEE International Conference on Control Applications*, Hawaii, Vol. 1, 206-212, Aug. 1999.
31. Zhang, Y. and P. G. Mehta, "Feedforward-feed Back Adaptive Control Design and Stability Analysis," *Proceedings of the International Federation of Automatic Control World Congress*, Beijing, China, Vol. 10, 409- 414, Jul. 1998.
32. Zhang, Y., P. G. Mehta, B. R. Bitmead, and C. R. Johnson, "Direct Adaptive Control for Tonal Disturbance Ejection," *Proceedings of the Automatic Control Conference (ACC)*, Philadelphia, PA, Vol. 3, 1480-1482, Jun. 1998.
33. Mehta, P. G. , A. C. Zander, W. P. Patrick, and Y. Zhang, "Active Acoustic Treatment (AAT)- A step Towards a Perfect Sound Absorber," *Proceedings of the American Control Conference (ACC)*, Philadelphia, PA, Vol. 4, 2611-2615, Jun. 1998.
34. Patrick, W. P., A. C. Zander, P. G. Mehta, N. Nishimura, and K. Ohnishi, "Development of Active Acoustic Treatment Phase 2: Duct Test of AAT Sheet," *Proceedings of the ACTIVE97*, Budapest, Hungary, 331-344, Aug. 1997.
35. Mehta, P. G., Y. Zheng, Y. Chait, and C. V. Hollot, "A New Approach to Active Noise Control in Duct," *Proceedings of the ASME Active Control of Vibration and Noise*, Vol. DE, 25-36, Nov. 1996.
36. Chait, Y., C. V. Hollot, P. G. Mehta, and Y. Zheng, "Active Noise Control in Ducts Using Non-adaptive Feedforward-Feedback Control," *Proceedings of the Noise Conference*, Bellevue, Washington, 397-383, Sept. 1996.
37. Mehta, P. G. , Y. Zheng, C. V. Hollot, and Y. Chait, "Active Noise Control in Ducts: Feedforward-Feedback Design by Blending H-infinity and QFT Methods," *Proceedings of the XIII International Federation of Control (IFAC) World Congress*, San Francisco, CA, Vol. H, 191-197, Jul. 1996.

Invited Lectures

1. "Model reduction via aggregation: An information theoretic interpretation of spectral cut," Department of Mechanical Engineering, University of Buffalo, New York, April 2009.
2. "Information theoretic paradigms for dynamical systems, CSDy Seminar, University of California at Santa Barbara, February 2009.
3. "Symmetry in interconnected systems and networks," TAM seminar series, Department of Theoretical and Applied Mechanics, Cornell University, NY, October 2008
4. "Fundamental Limitations in Control," CSDy Seminar, Department of Electrical and Computer Engineering, University of Minnesota, Minneapolis, MN, September 2008
5. "Fundamental Limitations in Control of Nonlinear Dynamics," Department of Mechanical and Aerospace Engineering, University of Florida, Gainesville, FL, September 2008
6. "Fundamental Limitations in Control," Northeastern University, Boston, MA, November 2, 2007.
7. "Model Reduction for Reduced Order Estimation in Traffic Models National Institute of Standards and Technology," Maryland, July 16 2007.
8. "Markov Chains, Entropy, & Fundamental Limitations in Nonlinear Control," University of California at Santa Barbara, July 21 2007.
9. "Fundamental Limitations in Estimation and Control of Dynamic Network Problems," Smart Transportation Workshop RTAS, Seattle, WA April 2007.
10. "Markov chains, Entropy, and Fundamental limitations in Nonlinear Stabilization," Dept. of Electrical & Computer Engineering, Amherst, April 13, 2006.
11. "Fundamental limitations in the Estimation and Control problems in Networks," United Technologies Research Center, East Hartford, April 11, 2006.
12. "Markov chains, Entropy, and Fundamental limitations in Nonlinear Stabilization," Coordinated Sciences Laboratory (CSL), UIUC, March 15, 2006.
13. "Stability of Non-Equilibrium Behavior," PASCO Seminar, "University of Paderborn, Germany, Dec. 2005.
14. "Dynamical Perspectives on Control of Non-equilibrium behavior," MATH/ME Seminar series, UIUC, November 15, 2005.
15. "Representation of Dynamics on Graph: Application to Building Systems," Coordinated Sciences Laboratory (CSL), UIUC, December 10, 2006.
16. "Near-degeneracy, Homotopy, and Nonbifurcating Solutions," PASCO Seminar, University of Paderborn, Germany, Jun. 2004.

Other Significant Lectures

12. "Modeling and Control of Thermoacoustic Instabilities in Military Engines," AFOSR Contractors Meeting, San Destin, FL, Sept. 2003
13. Mehta, P. G., "Symmetry Methods, Global Modes, and Graph Decomposition," DARPA Workshop on Design of Robust Dynamical Systems, East Hartford, CT, Jan. 2004
14. Mehta, P. G. and A. Banaszuk, "Modeling and Control of Thermoacoustic Instabilities in Military Engines," AFOSR Contractors Meeting, Pasadena, CA, Aug. 2004

Teaching

Spring 2006 and 2008: ME 598 Stochastic Methods in Dynamical Systems [New course created]

Spring 2007: ECE 528/ME 546 Nonlinear Systems Analysis

Fall 2006, 2007 and 2008: ME 360 Signal Processing, Instrumentation and Control

Organizational activities

1. "Dynamical Systems in Control," invited session organized (with U. Vaidya) in Conference of Decision and Control, San Diego, Dec 2006
2. "Control and Integration in Building Systems," tutorial session organized (with H. Sane) in American Control Conference, New York, July 2007
3. "Estimation of Multi-scale Dynamic Phenomena in Buildings," invited session organized (with A. Banaszuk) in American Control Conference, Seattle, June 2008
4. "Complex Systems: Multi-player models," invited session organized (with S. P. Meyn) in Conference of Decision and Control, Cancun, Dec 2008

Service

Program Committee member for the American Control Conference, Maryland, 2010

Program Committee Member, 6th International Conference on Informatics in Control, Automation and Robotics 2009

Program Committee member and an Associate editor for the American Control Conference, St. Louis, 2009

Program Committee member and an Associate editor for the Control over Communication Channels Workshop (ConCom 09), Korea

Associate Editor for the Allerton-07, Allerton-08

Associate Editor for the American Control Conference, Seattle 2008

NSF panel reviewer for the NSF CMS program on Dynamical Systems, 2007

Track leader for the "Intelligent Building systems" track at the American Control Conference, NY 2007

Associate Editor for the American Control Conference, NY 2007

NSF panel reviewer for the NSF CMS program on Dynamical Systems, 2006

Reviewer Information

Reviewer for *Automatica*, *ASME Journal of Computational and Nonlinear Dynamics*, *Control Engineering Practice*, *IEEE Transactions on Automatic Control*, *IEEE Transactions on Control Systems Technology*, *International Journal of Thermal Sciences*, *Nonlinear Dynamics Journal*, *Physics of Fluids*

Professional Societies and Services:

Member of **IEEE** (Control Systems Society)

Member of **SIAM** (Dynamical Systems Group)