Michael C. Rotkowitz

CURRICULUM VITAE

CONTACT INFORMATION

Dept. of Electrical & Computer Eng.
Rm. 2259, A.V. Williams Building
The University of Maryland
College Park, MD 20742 USA

mcrotk@umd.edu
Office: +1-301-405-2765
Mobile: +1-202-680-3797
http://www.isr.umd.edu/~mcrotk/

HONORS AND AWARDS

General Contribution Awards

- 2011 SIAM Control and Systems Theory Prize.
  (Conferred: "for Contributions to the theory of optimal controller synthesis for decentralized systems subject to information and control constraints.")

Funding Agency Awards

- Presidential Early Career Award for Scientists and Engineers (PECASE)
- 2014 NSF CAREER Award

Major Best-Paper Awards

- 2007 George S. Axelby Outstanding Paper Award
  (best paper in the IEEE Transactions on Automatic Control, 2005-2006).
- Young Author Prize, 17th IFAC World Congress, 2008
  (best paper at IFAC with all authors under the age of 35).
- Best Student-Paper Award, 44th IEEE Conference on Decision and Control and 2005 European Control Conference (CDC-ECC '05).

Fellowships

- Queen Elizabeth II Fellowship, Australian Research Council, 2011-2015.
- Future Generation Fellowship, University of Melbourne, 2008-2010.
- Fellowship in Networked Embedded Control, Swedish Research Council, 2005-2007.
- Stanford Graduate Fellowship / Cleve B. Moller Fellowship, 1999-2002.

Other Honors

- Outstanding Reviewer, Automatica, 2006-2007.
- Best Paper Award, Session on Local Area Augmentation Systems, Institute of Navigation GPS Conference 1999.
- Received the only degree in Mathematical and Computational Science to be conferred both with Departmental Honors and with Distinction, 1996.
- Sole award for top score, Actuarial Examination 100, a test of calculus and linear algebra administered by the Casualty Actuarial Society and the Society of Actuaries, 1994.
- Scholar Athlete Award, Stanford Track and Field, 1993.

Academic Positions

Current Appointments

- Assistant Professor, Department of Electrical and Computer Engineering (ECE), University of Maryland, January 2012 - present
- Assistant Professor, Institute for Systems Research (ISR), University of Maryland, June 2012 - present
- Assistant Professor, Applied Mathematics & Statistics, and Scientific Computation Program (AMSC), December 2015 - present

Prior Positions

- Queen Elizabeth II Fellow / Senior Research Fellow, Department of Electrical and Electronic Engineering (EEE), The University of Melbourne, January 2011 - December 2011
- Future Generation Fellow / Senior Research Fellow, Department of Electrical and Electronic Engineering (EEE), The University of Melbourne, September 2009 - December 2010
- Future Generation Fellow / Research Fellow, Department of Electrical and Electronic Engineering (EEE), The University of Melbourne, January 2008 - September 2009
- Honourary Fellow, Department of Mathematics and Statistics, The University of Melbourne, January 2008 - December 2011
- Research Fellow, Research School of Information Sciences and Engineering (RSISE), The Australian National University (ANU), Canberra, Australia, October 2006 - January 2008
- Postdoctoral Fellow, Automatic Control Laboratory, School of Electrical Engineering, Royal Institute of Technology (KTH), Stockholm, Sweden, August 2005 - August 2006

Other Experience (Selected)

- Graduate Student Trainee - Engineering, GS-11, Flight Controls Technology Group, Rotorcraft Division, NASA Ames Research Center, Moffett Field, California, USA, June 2000 - September 2000
- Analyst (Statistician and Software Engineer), JP Morgan Investment Management, New York, New York, USA, August 1996 - September 1998

Education

Stanford University

Ph.D. Aeronautics and Astronautics, June 2005

- Dissertation: "Tractable Problems in Optimal Decentralized Control"
- Thesis Committee: Sanjay Lall (advisor), Stephen Boyd, Claire Tomlin

M.S. Statistics, March 2005

- GPA: 4.0

M.S. Aeronautics and Astronautics, June 2000

- GPA: 4.0

B.S. Mathematical and Computational Science, June 1996

- Interdisciplinary major comprised Statistics, Mathematics, Computer Science, and Operations Research
- Advisor: Brad Efron
- GPA: 4.0 in major; 3.8 overall

INVITED TALKS (SELECTED)

Plenary Lectures / Special Lectures

- Tutorial Lecture, 51st IEEE Conference on Decision and Control, Maui, USA, December 2012.
- Semi-Plenary Lecture, 20th International Symposium on Mathematical Theory of Networks and Systems, Melbourne, Australia, July 2012.
- SIAM Control and Systems Theory Prize Lecture, Baltimore, Maryland, July 2011.
- Main Lecturer, *Summer School on Distributed Control and Estimation*, Dutch Institute of Systems and Control (DISC), Noordwijkerhout, The Netherlands, June 2009.

Other Invited Lectures

- School of Electrical Engineering and Computing, The University of Newcastle, Newcastle, Australia, August 2017.
- *USC Workshop on Future Directions in Networks, Optimization & Controls*, The University of Southern California, Los Angeles, California, December 2014.
- *Intelligent Automation, Inc. (IAI) Colloquia Series*, Institute for Systems Research, The University of Maryland, College Park, Maryland, December 2013.
- *Seminar in Electrical and Electronic Engineering*, University of Melbourne, Melbourne, Australia, March 2011.
- Department of Electrical Engineering and Computer Science, The University of Michigan, Ann Arbor, Michigan, March 2011.
- Department of Electrical and Computer Engineering, The University of Maryland, College Park, Maryland, March 2011.
- Department of BioStatistics Seminar, The University of California at Los Angeles (UCLA), Westwood, California, August 2010.
- California Institute of Technology, Pasadena, California, September 2008.
- The University of California at Los Angeles (UCLA), Westwood, California, July 2008.
- California Institute of Technology, Pasadena, California, July 2008.
- *HyNet Colloquium Series*, The University of Maryland, College Park, Maryland, December 2007.
- *Seminar in Electrical and Electronic Engineering*, University of Melbourne, Melbourne, Australia, August 2007.
- *GRASP Laboratory*, University of Pennsylvania, Philadelphia, Pennsylvania, July 2007.
- *Seminar in Electrical Engineering*, Yale University, New Haven, Connecticut, July 2007.
- *PRISM Lecture Series*, City College of New York (CCNY), New York, New York, July 2007.
- *Seminar in Electrical and Electronic Engineering*, University of Melbourne, Melbourne, Australia, March 2007.

- *InfoEng Seminar Series*, The Australian National University, Canberra, Australia, February 2007.
- *International Workshop on Linear Systems*, The Australian National University, Canberra, Australia, February 2007.
- *Seminar in Electrical Engineering and Computer Science*, University of California at Berkeley, Berkeley, California, December 2006.
- *Special Seminar in Electrical Engineering*, Stanford University, Stanford, California, December 2006.
- *Seminar in Applied Mathematics and Statistics*, University of California at Santa Cruz, Santa Cruz, California, December 2006.
- *GRASP Laboratory*, University of Pennsylvania, Philadelphia, Pennsylvania, June 2006.
- Tutorial Workshop on "Advances in Networked Autonomous Vehicles: Technologies, Tools, and Case Studies", *IEEE International Conference on Robotics and Automation*, Orlando, Florida, May 2006.
- *Seminar in Optimization and Systems Theory*, Department of Mathematics, Royal Institute of Technology, Stockholm, Sweden, April 2006.
- *Seminar in Control and Communication*, Linköping University, Linköping, Sweden, April 2006.
- *Embedded Reasoning Area*, Palo Alto Research Center (PARC), Palo Alto, California, March 2006.
- *Control Group Seminar*, University of Cambridge, Cambridge, U.K., March 2006.
- *Seminar in Automatic Control*, Lund Institute of Technology, Lund, Sweden, February 2006.
- Workshop on "Control, Estimation, and Optimization of Interconnected Systems: From Theory to Industrial Applications", *44th IEEE Conference on Decision and Control and 2005 European Control Conference (CDC-ECC 05)*, Seville, Spain, December 2005.
- *Seminar in Automatic Control*, Lund Institute of Technology, Lund, Sweden, June 2005.
- *Signals, Sensors, and Systems Seminar*, Royal Institute of Technology, Stockholm, Sweden, June 2005.
- *Stanford University Seminar on Guidance, Navigation, and Control*, Stanford, California, May 2005.
- *UCSC School of Engineering Control Group Seminar*, Santa Cruz, California, May 2005.

Grants and Contracts

- "CAREER: Decentralization and Parsimony for Implementable Control of Massively Interconnected Systems", sole PI, the National Science Foundation, US$400,000.00, February 2014 - February 2019.
- "Optimal Control with Decentralised Information", QEII Fellow / lead CI, Australian Research Council Discovery Project, AU$716,000.00, January 2011 - December 2015.
- "Online Determination of Active Variables: Recursive Sparse Estimation", sole CI, University of Melbourne Early Career Researcher grant, AU$39,253.49, January 2011 - June 2012.
- "Decentralized Control of Complex Systems: When to Look Beyond Linearity", sole CI, Melbourne School of Engineering Early Career Researcher grant, AU$9,418.00, January 2010 - December 2010.

Professional Activities (Selected)

- Session Organizer and Session Chair, "The Witsenhausen Counterexample: 40 Years Later", 47th IEEE Conference on Decision and Control, Cancun, Mexico, December 2008.
- International Program Committee, 6th IFAC Workshop on Distributed Estimation and Control in Networked Systems, Tokyo, Japan, September 2016.
- International Program Committee, 5th IFAC Workshop on Distributed Estimation and Control in Networked Systems, Philadelphia, Pennsylvania, USA, September 2015.
- International Program Committee, 4th IFAC Workshop on Distributed Estimation and Control in Networked Systems, Koblenz, Germany, September 2013.
- Technical Program Committee, 3rd IFAC Workshop on Distributed Estimation and Control in Networked Systems, Santa Barbara, California, USA, September 2012.
- Frequent Session Chair and Co-Chair at IEEE, SIAM, and IFAC conferences on topics including decentralized control and recursive identification.
- Frequent Reviewer: IEEE Transactions on Automatic Control; Automatica; SIAM Journal on Control and Optimization; IEEE Transactions on Control of Network Systems; IEEE Conference on Decision and Control (CDC); IFAC Workshop on Distributed Estimation and Control in Networked Systems (NecSys); International Symposium on Mathematical Theory of Networks and Systems (MTNS); American Control Conference (ACC).
- Occasional Reviewer: Systems and Control Letters; AIAA Journal of Guidance, Navigation, and Control; International Journal of Systems, Control, and Communications; International Journal of Control; IET Control Theory and Applications; IEEE International Symposium on Intelligent Control.
- Member: IEEE (Control Systems Society, Signal Processing Society), SIAM (Activity Group on Control and Systems Theory, Activity Group on Optimization), AIAA, ASA, IMS, SSAI, Society for the Study of Evolution.

Publications

A. Alavian and M.C. Rotkowitz. "Constructive Stabilization and Pole Placement by Arbitrary Decentralized Architectures", `arXiv:1704.01674v1 [cs.SY]`, April 2017.

S. Sabău, N.C. Martins, M.C. Rotkowitz. "A Convex Characterization of Multidimensional Linear Systems Subject to SQI Constraints", *IEEE Transactions on Automatic Control*, vol. 62, no. 6, pp. 2981-2986, June 2017.

A. Alavian and M.C. Rotkowitz. "Improving ADMM-based Optimization of Mixed Integer Objectives", *Proceedings of the 51st Annual Conference on Information Sciences and Systems*, March 2017.

A. Alavian and M.C. Rotkowitz. "Minimization of a Particular Singular Value", *Proceedings of the 54th Annual Allerton Conference on Communication, Control, and Computing*, pp. 974-981, September 2016.

A.K. Yadav, R. Ranjan, U. Mahbub, and M.C. Rotkowitz. "New Methods for Handling Binary Constraints", *Proceedings of the 54th Annual Allerton Conference on Communication, Control, and Computing*, pp. 1074-1080, September 2016.

A. Koochakzadeh, S. Miran, P. Samangouei, and M.C. Rotkowitz. "Nonnegative Matrix Factorization by Optimization on the Stiefel Manifold with SVD Initialization", *Proceedings of the 54th Annual Allerton Conference on Communication, Control, and Computing*, pp. 1068-1073, September 2016.

A. Alavian and M.C. Rotkowitz. "Polynomial Optimization Methods for Determining Lower Bounds on Decentralized Assignability", *Proceedings of the 54th Annual Allerton Conference on Communication, Control, and Computing*, pp. 1054-1059, September 2016.

A. Alavian and M.C. Rotkowitz. "Enhanced Approximation of the Decentralized Assignability Measure by Subgradient Methods", *Proceedings of the 22nd International Symposium on Mathematical Theory of Networks and Systems*, pp. 511-514, July 2016.

A. Alavian and M.C. Rotkowitz. "An Optimization-based Approach to Decentralized Assignability", *Proceedings of the 2016 American Control Conference*, pp. 5199-5205, July 2016.

A. Alavian and M.C. Rotkowitz. "On a Hankel-based Measure of Decentralized Controllability and Observability", *Proceedings of the 5th IFAC Workshop on Distributed Estimation and Control in Networked Systems*, September 2015.

M.C. Rotkowitz. "A Counterexample and Fix to a Minimum Distance Duality Theorem", `arXiv:1507.08021v2 [math.OC]`, August 2015.

V.S. Mai, D. Maity, B. Ramasubramanian, and M. Rotkowitz. "Convex Methods for Rank-Constrained Optimization Problems", *Proceedings of the 2015 SIAM Conference on Control and Its Applications*, pp. 123-130, July 2015.

A. Alavian and M.C. Rotkowitz. "On the Pole Selection for $\mathcal{H}_\infty$-optimal Decentralized Control", *Proceedings of the 2015 American Control Conference*, pp. 5471-5476, July 2015.

A. Alavian and M.C. Rotkowitz. "Decentralized Non-Overshooting Stabilization", *Proceedings of the 2015 American Control Conference*, pp. 4785-4790, July 2015.

A. Alavian and M. Rotkowitz. "Stabilizing Decentralized Systems with Arbitrary Information Structure", *Proceedings of the 53st IEEE Conference on Decision and Control*, pp. 4032-4038, December 2014.

M. Fathy and M.C. Rotkowitz. "Essential Matrix Estimation Using Adaptive Penalty Formulations", *Proceedings of the 25th British Machine Vision Conference*, September 2014.

A. Alavian and M.C. Rotkowitz. "Fixed Modes of Decentralized Systems with Arbitrary Information Structure", *Proceedings of the 21st International Symposium on Mathematical Theory of Networks and Systems*, pp. 913-919, July 2014.

T. Gan and M.C. Rotkowitz. "Decomposition of Data Rate Allocation for Stabilization over Networks", *Proceedings of the 4th IFAC Workshop on Distributed Estimation and Control in Networked Systems*, pp. 389-396, September 2013.

A. Alavian and M.C. Rotkowitz. "Q-Parametrization and an SDP for $\mathcal{H}_\infty$-optimal Decentralized Control", *Proceedings of the 4th IFAC Workshop on Distributed Estimation and Control in Networked Systems*, pp. 301-308, September 2013.

A. Mahajan, N.C. Martins, M.C. Rotkowitz, and S. Yüksel. "Information Structures in Optimal Decentralied Control", *Proceedings of the 51st IEEE Conference on Decision and Control*, pp. 1291-1306, December 2012.

A. Dehghani, M. Rotkowitz, B.D.O. Anderson and S.H. Cha. "Simplified Rapid Switching Gain Scheduling for a class of LPV Systems", *IEEE Transactions on Automatic Control*, vol. 57, no. 10, pp. 2633-2639, October 2012.

M.C. Rotkowitz and N.C. Martins. "On the Nearest Quadratically Invariant Constraint", *IEEE Transactions on Automatic Control*, vol. 57, no. 5, pp. 1314-1319, May 2012.

M.C. Rotkowitz and N.C. Martins. "On the Number of Iterations to the Closest Quadratically Invariant Information Constraint", *Proceedings of the 18th IFAC World Congress*, pp. 9115-9120, August 2011.

M.C. Rotkowitz. "Parametrization of Stabilizing Controllers Subject to Subspace Constraints", *Proceedings of the 2011 American Control Conference*, pp. 5370-5375, July 2011.

M. Rotkowitz. "Decentralized Control and Algebraic Approaches", Chapter 74, *The Control Handbook*, 2nd Edition, W. Levine (editor), CRC Press Inc., 2011.

M. Rotkowitz. "Parametrization of All Stabilizing Controllers Subject to Any Structural Constraint", *Proceedings of the 49th IEEE Conference on Decision and Control*, pp. 108-113, December 2010.

M. Rotkowitz, R. Cogill, and S. Lall. "Convexity of Optimal Control over Networks with Delays and Arbitrary Topology", special issue on "Information Processing and Decision Making in Distributed Control Systems", *International Journal of Systems, Control, and Communications*, vol. 2, no. 1/2/3, pp. 30-54, 2010.

M.C. Rotkowitz and N.C. Martins. "On the Closest Quadratically Invariant Constraint", *Proceedings of the 48th IEEE Conference on Decision and Control*, pp. 1607-1612, December 2009.

L. Blackhall and M. Rotkowitz. "Using an Information Filter to Speed Computation of Sparse Parameter Estimates", *Proceedings of the 48th IEEE Conference on Decision and Control*, pp. 7238-7243, December 2009.

L. Blackhall and M. Rotkowitz. "Estimating the Interconnection Structure of Dynamical Networks", *Proceedings of the 2009 European Control Conference*, pp. 2954-2959, August 2009.

L. Blackhall and M. Rotkowitz. "Maximum Aposteriori vs Maximum Probability Recursive Sparse Estimation", *Proceedings of the 2009 European Control Conference*, pp. 472-477, August 2009.

Y. Feng, B.D.O. Anderson, and M. Rotkowitz. "A Game Theoretic Algorithm to Compute Local Stabilizing Solutions to HJBI Equations in Nonlinear H_∞ Control", *Automatica*, vol. 45, no. 4, pp. 881-888, April 2009.

W. Griggs, B.D.O. Anderson, A. Lanzon, and M. Rotkowitz. "Interconnections of Nonlinear Systems with "Mixed" Small Gain and Passivity Properties and Associated Input-Output Stability Results", *Systems and Control Letters*, vol. 58, no. 4, pp. 289-295, April 2009.

M. Rotkowitz. "On Information Structures, Convexity, and Linear Optimality", *Proceedings of the 47th IEEE Conference on Decision and Control*, pp. 1642-1647, December 2008.

A. Lanzon, Y. Feng, B.D.O. Anderson, and M. Rotkowitz. "Computing the Positive Stabilizing Solution to Algebraic Riccati Equations with an Indefinite Quadratic Term via a Recursive Method", *IEEE Transactions on Automatic Control*, vol. 53, no. 10, pp. 2280-2291, November 2008.

M. Rotkowitz and R. Cogill. "Convex Synthesis of Distributed Controllers for Spatio-Temporal Systems with Subadditive Support Functions", *Proceedings of the 46th Allerton Conference on Communication, Control, and Computing*, pp. 1450-1456, September 2008.

M. Rotkowitz and G. Nair. "An LP for Stabilization over Networks with Rate Constraints", *Proceedings of the 18th International Symposium on Mathematical Theory of Networks and Systems*, July 2008.

S.H. Cha, M. Rotkowitz, and B.D.O. Anderson. "Gain Scheduling Using Time-Varying Kalman Filter for a Class of LPV Systems", *Proceedings of the 17th IFAC World Congress*, July 2008.

L. Blackhall and M. Rotkowitz. "Recursive Sparse Estimation using a Gaussian Sum Filter", *Proceedings of the 17th IFAC World Congress*, July 2008.

Y. Feng, M. Rotkowitz, and B.D.O. Anderson. "An Iterative Procedure to Compute Local Nonnegative Stabilizing Smooth Solutions to HJBI Equations in Nonlinear H_∞ Control", *Proceedings of the 17th IFAC World Congress*, July 2008.

W. Griggs, B.D.O. Anderson, A. Lanzon, and M. Rotkowitz. "A Stability Result for Interconnections of Nonlinear Systems with "Mixed" Small Gain and Passivity Properties", *Proceedings of the 46th IEEE Conference on Decision and Control*, pp. 4489-4494, December 2007.

M. Rotkowitz. "Linear Controllers are Uniformly Optimal for the Witsenhausen Counterexample", *Proceedings of the 45th IEEE Conference on Decision and Control*, pp. 553-558, December 2006.

M. Rotkowitz. "Parameterization of Causal Stabilizing Controllers over Networks with Delays", *Proceedings of the 49th IEEE Global Telecommunications Conference*, November 2006.

M. Rotkowitz and S. Lall. "Affine Controller Parameterization for Decentralized Control over Banach Spaces", *IEEE Transactions on Automatic Control*, vol. 51, no. 9, pp. 1497-1500, August 2006.

M. Rotkowitz and S. Lall. "Convexification of Optimal Decentralized Control Without a Stabilizing Controller", *Proceedings of the 17th International Symposium on Mathematical Theory of Networks and Systems*, July 2006.

M. Rotkowitz. "Information Structures Preserved Under Nonlinear Time-Varying Feedback", *Proceedings of the American Control Conference*, pp. 4207-4212, June 2006.

R. Cogill, M. Rotkowitz, B. Van Roy, and S. Lall. "An Approximate Dynamic Programming Approach to Decentralized Control of Stochastic Systems", *Lecture Notes in Control and Information Sciences* vol. 329, Control of Uncertain Systems: Modeling, Approximation, and Design, pp. 243-256, April 2006.

M. Rotkowitz. "Sensitivity Analysis of Closed-Loop Controller Performance: A Model-Based Bootstrap Approach", *Proceedings of the IFAC Symposium on System Identification*, March 2006.

M. Rotkowitz and S. Lall. "A Characterization of Convex Problems in Decentralized Control", *IEEE Transactions on Automatic Control*, vol. 51, no. 2, pp. 274-286, February 2006.

M. Rotkowitz, R. Cogill, and S. Lall. "A Simple Condition for the Convexity of Optimal Control over Networks with Delays", *Proceedings of the IEEE Conference on Decision and Control*, pp. 6686-6691, December 2005.

M. Rotkowitz. "Tractable Problems in Optimal Decentralized Control", Doctoral Dissertation, Stanford University, June 2005.

M. Rotkowitz and S. Lall. "Decentralized Control Subject to Communication and Propagation Delays", *Proceedings of the 43rd IEEE Conference on Decision and Control*, pp. 4990-4997, December 2004.

R. Cogill, M. Rotkowitz, B. Van Roy, and S. Lall. "An Approximate Dynamic Programming Approach to Decentralized Control of Stochastic Systems", *Proceedings of the 42nd Allerton Conference on Communication, Control, and Computing*, September 2004.

M. Rotkowitz and S. Lall. "On Computation of Optimal Controllers Subject to Quadratically Invariant Sparsity Constraints", *Proceedings of the American Control Conference*, pp. 5659-5664, June 2004.

M. Rotkowitz and S. Lall. "Decentralized Control of Unstable Systems and Quadratically Invariant Information Constraints", *Proceedings of the 42nd IEEE Conference on Decision and Control*, pp. 2865-2871, December 2003.

M. Rotkowitz and S. Lall. "Decentralized Control Information Structures Preserved Under Feedback", *Proceedings of the 41st IEEE Conference on Decision and Control*, pp. 569-575, December 2002.

L. Lipera, J. Colbourne, M. Tischler, M. Mansur, M. Rotkowitz, and P. Patangui. "The Micro Craft iSTAR Micro Air Vehicle: Control System Design and Testing", *Proceedings of the American Helicopter Society 57th Annual Forum*, May 2001.

S. Matsumoto, S. Pullen, M. Rotkowitz, and B. Pervan. "GPS Ephemeris Verification for Local Area Augmentation System (LAAS) Ground Stations", *Proceedings of the Institute of Navigation GPS Conference*, pp. 691-703, September 1999.