

Curriculum Vitae

Gary J. Balas

Aerospace Engineering and Mechanics
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Education

- December 1989 **California Institute of Technology**
Doctor of Philosophy in Aeronautics and Astronautics
Robust Control of Flexible Structures: Theory and Experiments
- June 1984 **University of California, Irvine**
Master of Science in Civil and Electrical Engineering
- July 1982 **University of California, Irvine**
Bachelor of Science in Civil and Electrical Engineering

Professional Experience

- 6/01–present Professor. Department of Aerospace Engineering and Mechanics,
and Control Science and Dynamical Systems Center.
University of Minnesota, Minneapolis, MN.
- 3/95–present Co-Director, Control Science and Dynamical Systems Center.
University of Minnesota, Minneapolis, MN.
- 7/06–1/14 Head. Department of Aerospace Engineering and Mechanics,
University of Minnesota, Minneapolis, MN.
- 1/92–6/06 Director of Graduate Studies. Control Science and Dynamical Systems Center.
University of Minnesota, Minneapolis, MN.
- 6/02–8/04 Director of Graduate Studies. Aerospace Engineering and Mechanics,
University of Minnesota, Minneapolis, MN.
- 9/96–6/01 Associate Professor. Department of Aerospace Engineering and Mechanics,
and Control Science and Dynamical Systems Center.
University of Minnesota, Minneapolis, MN.
- 1/90–9/96 Assistant Professor. Department of Aerospace Engineering and Mechanics,
and Control Science and Dynamical Systems Center.
University of Minnesota, Minneapolis, MN.
- 7/90–1/91 Visiting Research Fellow. Department of Electrical Engineering.
California Institute of Technology, Pasadena, CA.
- 9/84–12/89 Research Assistant. *California Institute of Technology, Pasadena, CA.*
- 9/87–6/88 Teaching Assistant. *California Institute of Technology, Pasadena, CA.*
- 5/84–9/84 Staff Engineer. *HR Textron Systems Group, Irvine, CA.*

- 9/82–5/84 Research and Teaching Assistant.
University of California, Irvine, Irvine, CA.
- 9/82–9/84 Staff Engineer. *Hughes Aircraft Company, Fullerton, CA.*
- 5/79–9/82 Bachelor Fellowship Engineer. *Hughes Aircraft Company, Fullerton, CA.*

University of Minnesota Teaching

- Undergraduate Design, Model, Simulation, Build, Fly Uninhabited Aerial Vehicles
 Introduction to Engineering
 Dynamics of Systems and Structures
 Dynamics
 Deformable Body Mechanics
 System Dynamics
 Automatic Flight Control Systems
 Dynamics and Control Laboratory
 Mathematical Modeling and Simulation in Aerospace Engineering[-16pt]
- Graduate Advanced Classical Control Design
 Robust Multivariable Control Design
 Modern Control Theory
 Computer Aided Control Design
 Selected Topics in Dynamical Systems and Control
 Seminar in Control and Dynamical Systems
 System Identification

Honors and Awards

- 2012 Honorary Member, Hungarian Academy of Engineering
- 2012 Plenary Speaker, 7th IFAC Symposium on Robust Control Design, Aalborg, Denmark
- 2010 Prize for the Development of the Hungarian Aeronautical Science, Hungarian Scientific Association for Transport
- 2010 Plenary Speaker, 2nd Workshop on Clearance of Flight Control Laws, Stockholm, Sweden
- 2009 Plenary Speaker, 49th Israel Annual Conference on Aerospace Sciences, Tel Aviv and Haifa, Israel
- 2007 Distinguished McKnight University Professor, University of Minnesota
- 2006 O. Hugo Schuck Best Paper Award, American Automatic Control Council (with T. Keviczky)
- 2005 Control Systems Technology Award, IEEE Control System Society (with Prof. A.K. Packard)
- 2005-2006 Fellow, Committee on Institutional Cooperation Academic Leadership Program
- 2005 Semi-Plenary Speaker, 16th International Federation of Automatic Control (IFAC) World Congress, Prague, Czech Republic (with Prof. J. Bokor)
- 2004 Fellow, IEEE
- 2004 Plenary Speaker, Technical University of Delft Center for Systems and Control, “Challenges for the 21st Century”
- 2003 Institute of Technology George Taylor Distinguished Research Award, University of Minnesota
- 2003 Semi-Plenary Speaker, European Control Conference, Cambridge, England
- 2002 Associate Fellow, AIAA

2002-04	Senior Member, IEEE
2002	Session Plenary Speaker, International Council of Aeronautical Sciences Conference, Toronto
1999	Outstanding Young Investigator Award, ASME Dynamic Systems and Control
1993-1995	McKnight-Land Grant Professorship, University of Minnesota
1989-90, 2002	American Control Conference Best Paper Presentation in Session
1986-89	NASA Graduate Student Fellowship
1986	Donald Wills Douglas Fellowship in Aeronautics
1982-84	Hughes Aircraft Graduate Student Fellowship
1980-82	Hughes Aircraft Undergraduate Student Fellowship

Uninhabited Aerial Vehicles (UAV) Research Laboratory: www.uav.aem.umn.edu

- Development and implementation of a low-cost, open source small UAV flight research facility.
- Research activities including control, navigation and guidance algorithms, embedded fault detection methods, flight control algorithm verification and validation, and system identification techniques.

Graduated Ph.D. Students

Jacob Reiner	Aerospace Engineering and Mechanics, University of Minnesota, June, 1993. Thesis title: <i>Control Design for Aircraft Using Robust Dynamic Inversion Techniques</i> . Currently a project manager at Rafael and an Adjunct Professor in the Aeronautics and Space Department at the Technion, Israel. (co-advised with Prof. W. Garrard, Dept. of Aerospace Engineering and Mechanics).
Mansour Karkoub	Mechanical Engineering, University of Minnesota, April, 1994. Thesis title: <i>Modeling and μ Synthesis Control of Flexible Manipulators: An Integrated Approach</i> . Currently a Professor in Mechanical Engineering Department, Texas A & M University, Qatar. (co-advised with Prof. K. Tamma, Dept. of Mechanical Engineering).
Rick Lind, Jr.	Aerospace Engineering and Mechanics, University of Minnesota, September, 1995. Thesis title: <i>Linear Matrix Inequalities for Robust Control: Theory, Algorithms and Applications</i> . Former NASA researcher at NASA Dryden Research Center, 1998–2001. Currently Associate Professor in Mechanical and Aerospace Engineering, University of Florida.
Peter Thomson	Aerospace Engineering and Mechanics, University of Minnesota, January, 1996. Thesis title: <i>Shape Memory Alloys for Structural Control</i> . Currently a Professor in the Departamento de Mecanica de Solidos, Universidad del Valle, Cali, Columbia. (co-advised with Prof. P. Leo, Dept. of Aerospace Engineering and Mechanics).
Sadok Hougui	Aerospace Engineering and Mechanics, University of Minnesota, April, 1996. Thesis title: <i>Robust Dynamic Inversion Flight Control</i> . Currently a project leader at Rafael in Israel. (co-advised with Prof. W. Garrard, Dept. of Aerospace Engineering and Mechanics).
Arun Kumar	Aerospace Engineering and Mechanics, University of Minnesota, October, 1996. Thesis title: <i>Use of PDEs in Image Processing. Control</i> . Currently employed at Intel. (co-advised with Prof. A. Tannenbaum, Dept. of Electrical Engineering).

- Volkan Nalbantoglu Aerospace Engineering and Mechanics, University of Minnesota, July, 1998. Thesis title: *Robust Control and System Identification for Flexible Structures*. Currently an Associate Professor at Middle East Technical University, Ankara, Turkey.
- Weizhong Lu Control Science and Dynamical Systems, University of Minnesota, June, 1999. Thesis title: *Norms and Optimal Control with Worst Case Disturbance Rejection*. Currently employed as a control engineer at Boeing, Houston, TX. (co-advised with Prof. EB. Lee, Dept. of Electrical Engineering).
- Jeffrey Barker Aerospace Engineering and Mechanics, University of Minnesota, September, 1999. Thesis title: *Linear, Parameter Varying Gain-Scheduled Control of Aerospace Systems*. Currently employed as a control engineer at Boeing Phantom Works, St. Louis, MO.
- Jong-Yeob Shin Aerospace Engineering and Mechanics, University of Minnesota, October, 2001. Thesis title: *Worst-Case Analysis and Linear Parameter-Varying Gain-Scheduled Control of Aerospace Systems*. Currently a research scholar at the National Institute of Aerospace, Hampton, VA.
- Raktim Bhattacharya Aerospace Engineering and Mechanics, University of Minnesota, December, 2002. Thesis title: *Transformation of Linear Control Algorithms into Operationally Optimal Real-Time Tasks*. Currently an Assistant Professor at Texas A & M University in College Station, TX.
- Andres Marcos Aerospace Engineering and Mechanics, University of Minnesota, December, 2003. Thesis title: *Aircraft Applications of Fault Detection and Isolation Techniques*. Currently a research engineer at DEIMOS-SPACE S.L., Spain.
- Subhabrata Ganguli Aerospace Engineering and Mechanics, University of Minnesota, October, 2004. Thesis title: *Use of Feedback to Address Flight Safety Issues*. Currently an engineer at Honeywell Laboratory, Minneapolis, Minnesota.
- Tamas Keviczky Control Science and Dynamical Systems, University of Minnesota, September, 2005. Thesis title: *Decentralized Receding Horizon Control of Large Scale Dynamically Decoupled Systems*. Currently an Assistant Professor at the Technical University of Delft, The Netherlands.
- Balint Vanek Aerospace Engineering and Mechanics, University of Minnesota, February, 2008. Thesis title: *Control Methods for High-Speed Supercavitating Vehicles*. Currently a research associate at Hungarian Academy of Science Computer and Automation Research Institute in Budapest, Hungary.
- Paw Yew Chai Aerospace Engineering and Mechanics, University of Minnesota, February, 2009. Thesis title: *Synthesis and Validation of Flight Control for UAV*. Currently a research engineer at Singapore DSO National Laboratories.
- Rohit Pandita Aerospace Engineering and Mechanics, University of Minnesota, December, 2010. Thesis title: *Dynamic Flight Envelope Assessment with Flight Safety Applications*. Currently a control engineer at Toyota Research Laboratory, Ann Arbor, MI.
- Arnar Hjartarson Aerospace Engineering and Mechanics, University of Minnesota, March, 2012. Thesis title: *Experimental Study of Control Laws for Supercavitating Vehicles*. Currently a research engineer at MUSYN Inc., Minneapolis, MN.
- Abhijit Chakraborty Aerospace Engineering and Mechanics, University of Minnesota, August, 2012. Thesis title: *Local Stability and Performance Analysis of Uncertain Dynamical Systems with Applications to Actuator Saturations*. Currently a research engineer at Cummins, Seymour, IN.

- Ahmet Arda Ozdemir Aerospace Engineering and Mechanics, University of Minnesota, January, 2013. Thesis title: *Wind Turbine Control Tradeoffs*. Currently a research engineer at The Mathworks, Natick, MA.
- Andrei Dorobantu Aerospace Engineering and Mechanics, University of Minnesota, September, 2013. Thesis title: *Test Platforms for Model-Based Flight Research*. Currently a research engineer at Seagate, Shakopee, MN.

Post-Doctoral Researchers and Research Associates

- Craig Shankwitz, Ph.D. 1993-94. Currently Associate Director of the Intelligent Transportation Systems (ITS) Institute, University of Minnesota.
- Greg Wolodkin, Ph.D. 1995-96. Currently lead software engineer on core Matlab at the MathWorks Inc., Natick, MA.
- Ian Fialho, Ph.D. 1997-98. Currently technical fellow at Boeing Space Systems, Houston, TX.
- George Papageorgiou, Ph.D. 1999-2000. Currently research engineer at Honeywell Laboratory, Minneapolis, MN.
- Francesco Borrelli, Ph.D. 2001-2003. Currently an Associate Professor in Mechanical Engineering at the University of California, Berkeley.
- Tamas Keviczky, Ph.D. 2005-2006. Currently an Assistant Professor in Systems and Control at the Technical University of Delft, The Netherlands.
- Balazs Kulcsar, Ph.D. 2006-2007. Currently an Assistant Professor at Chalmers University of Technology, Sweden.
- Qian Zheng, Ph.D. 2009-2010. Currently a senior scientist an air traffic management consulting company in Ames, CA.
- Peter Seiler, Ph.D. 2008-2011. Previously senior research engineer, Honeywell (2004-2008), Assistant Professor of Mechanical Engineering, University of Illinois, Champaign Urbana (2001-2004). Currently an Assistant Professor in the Department of Aerospace Engineering and Mechanics, University of Minnesota (Sept 2011).
- Jorge Sofrony Esmeral, Ph.D. 2011. Fullbright Scholar. Currently an Assistant Professor at the Universidad Nacional De Colombia, Bogota Colombia.
- Austin Murch, MS. 2010-2012. Former lead research on AirStar unmanned flight test platform at NASA Langley. Received his MS degree from Georgia Tech in 2006. Director of Uninhabited Aerial Vehicle (UAV) Laboratory, www.uav.aem.umn.edu.
- Brian Taylor, BS. 2012-present. Former lead flight control engineer on X-56a unmanned flight test platform at NASA Dryden. Received his BS degree from University of Colorado in 2008. Director of UAV Laboratory, www.uav.aem.umn.edu.
- Harald Pfifer, PhD. 2013-present. Former research engineer at DLR in Munich, Germany. Received the PhD degree from Technische Universität München.
- Bela Takarics, Ph.D. 2013-present. Fullbright Scholar. Currently a research scientist at MTA SZTAKI, Hungarian Academy of Sciences Computer and Automation Research Institute, Budapest, Hungary.
- Tamas Peni, Ph.D. 2014-present. Currently a research scientist at MTA SZTAKI, Hungarian Academy of Sciences Computer and Automation Research Institute, Budapest, Hungary.

Graduated Masters Students

Plan A

Rick Lind	“Control Design via Optimal Scaling,” November 1992.
Arun Kumar	“Model Validation Towards Better Robust Control Design,” March 1993.
Peter Thomson	“An Application of Shape Memory Alloys to Augment Structural Damping,” June 1994.
Joe Mueller	“Application of Linear Parameter-Varying Control Techniques to the F/A-18 Systems Research Aircraft,” August 2000.
Andres Marcos	“A Linear Parameter Varying Model of the Boeing 747-100/200 Longitudinal Motion,” January 2001.
Dorothea Czernik	“Modeling and Simulation of a Large Flexible Aircraft: Boeing 747-100,” June 2002.
Eric Euteneuer	“Studies on the Dynamics of a Supercavitating Torpedo,” August 2003.
Ryan Ingvalson	“ H_∞ Fault Detection Filter Design for a Closed-loop System,” May 2004.
Justin Syrstad	“Experimental Investigation of Wedge Shaped Fin and Supercavity Interaction,” January 2006.
Rohit Pandita	“Fault Diagnosis Filters and Controller Interaction for Uncertain Dynamical Systems,” January 2008.
Nikhil Godbole	“Study of Fault Detection and Isolation Filters on a Boeing 747 100/200,” March 2008.
Andrei Dorobantu	“Time Delay Margin Analysis for Adaptive Flight Control Laws,” December 2010.
Paul Freeman	“Robust, Model-based Fault Detection for Commercial Transport Air Data Probes,” November 2011.
David Escobar Sanabria	“Model and Control Validation of a High Speed Supercavitating Vehicle,” July 2012.

Plan B

Steve Sohm	“Introduction of Uncertainty in the Modeling of Multi-Degree of Freedom Systems,” April 1994.
Borfan Nan	“X29A Longitudinal Stabilizer Design,” April 1994.
Volkan Nalbantoglu	“Autopilot Design for Missiles,” June 1994.
Laura Weyer	“Simulation of Active Flutter Suppression Controllers,” December 1994.
Paul Blue	“Flutter Suppression for Aircraft,” May 1995.
Mary Slawski	“Comparison of H_∞ and P-I Control for a Stable Infinite Dimensional System,” June 1997.
Jack Ryan	“Control of Turbofan Engines,” August, 1999.
Wilson Ronda	“Design and Analysis of Multivariable Robust Longitudinal Axis Controllers for the NASA F/A-18 SRA,” April, 2000.
Subhabrata Ganguli	“System Identification and Design of Controllers for the Advanced Controls Technology Experimental (ACTEX) Flight Structure,” May 2000.
Raktim Bhattacharya	“Nonlinear Receding Horizon Control of a F-16 Aircraft,” December, 2000.
Katherine Zou	“Application of Nonlinear Receding Horizon Control to the F-16 Aircraft,” June 2002.

Richard Russell	“Upgrading the Flexible Structure Controller,” March 2004.
Tyler Ryan	“Dynamics and Control of Supercavitating Torpedoes,” December 2004.
Tessa Stranik	“Impulsive Control of a Spinning Projectile,” December 2006.
Chris Visker	“Precision Guided Mortar Munition Robustness and Agility Study,” May 2007.
Arnar Hjartarson	“Development of MO II Control Surface-Cavity Interaction Simulator,” June 2007.
Hamid Mokhtarzadeh	“Supercavitating Vehicle Modeling and Dynamics,” April 2010.
Abhijit Chakraborty	“Linear and Nonlinear Analysis of Susceptibility of F/A-18 Flight Control Laws to the Falling Leaf Mode,” May 2010.
Byron Saari	“Force Control of a Highly Inertial Specimen,” May 2010.
Hamid Mokhtarzadeh	“Supercavitating Vehicle Modeling and Dynamics,” June 2010.
Ahmet Arda Ozdemir	“Effects of Disturbance Augmented Control Design for Wind Turbines,” November 2010.
Claudia Moreno	“Model Reduction for Aeroservoelastic Vehicles,” November 2012.

Current PhD. Students

Paul Freeman	Expected degree date: July 2014.
David Escobar Sanabria	Expected degree date: September 2014.
Claudia Moreno	Expected degree date: September 2014.
Aditya Kotikalpudi	Expected degree date: December 2015.

Current Masters Students

Abhineet Gupta

Undergraduate Research Students

Will Johnson

Visiting Masters and PhD Students

Corne van Etten	Technical University of Delft, The Netherlands (2000)
Oreste Riccardo Natale	Università del Sannio, Benvento, Italy (2001)
Cristina Salvemini	Università del Sannio, Benvento, Italy (2002)
Pablo Falcone	Università del Sannio, Benvento, Italy (2003)
Martin Hanel	Universität Stuttgart, Germany (2003)
Alexander Hennig	Universität Stuttgart, Germany (2007)
Peter Bauer	Technical University of Budapest, Hungary (2007)
Matteo Corno	Politecnico di Milano, Italy (2008)
Michael Rimestad	University of Aalborg, Denmark (2008)
Harald Pfifer	Technische Universität München, Germany (2009)
David Escobar Sanabria	Universidad Nacional De Colombia, Bogota, Columbia (2009)
Ramin Geshnizjani	Universität Stuttgart, Stuttgart, Germany (2012)

Journal Publications

1. D. Escobar Sanabria, G.J. Balas, and R.E.A. Arndt "Modeling, Control and Experimental Validation of a High Speed Supercavitating Vehicle," *IEEE Journal on Ocean Engineering*, accepted February 2014.
2. P. Rosa, G.J. Balas, C. Silvestre and M. Athans, "A Synthesis Method of LTI MIMO Robust Controllers for Uncertain LPV Plants," *IEEE Trans. Auto. Cont.*, accepted Feb 2014.
3. A. Dorobantu, G.J. Balas, and T.T. Georgiou, "Validating Aircraft Models in the Gap Metric," *AIAA Journal of Aircraft*, accepted January 2014.
4. C. Moreno, P. Seiler, and G.J. Balas, "Model Reduction for Aeroelastic Systems," *AIAA Journal of Aircraft*, accepted June 2013.
5. A. Ozdemir, P. Seiler, and G.J. Balas, "Design Trade-offs of Wind Turbine Preview Control," *IEEE Control System Technology*, Vol. 21, no. 10, July 2013, pp. 1143-1152.
6. P. Freeman, G.J. Balas, and P. Seiler "Air Data System Fault Modeling and Detection," *Control Engineering Practice*, Vol. 21, no. 10, October 2013, pp. 1290-1301.
7. P. Freeman, R. Pandita, N. Srivastava, and G.J. Balas, "Model-based and Data-driven Fault Detection Performance for a Small UAV," *IEEE/ASME Trans. Mechatronics*, Vol. 18, no. 4, 2013, pp. 1300 - 1309.
8. E. Summers, A. Chakraborty, W. Tan, U. Topcu, P. Seiler, G.J. Balas, and A.K. Packard, "Quantitative L_2 -gain and Reachability Analysis for Nonlinear Systems," *Int. J. Robust and Nonlinear Control*, Vol. 23, no. 10, 2013, pp. 1115-1135.
9. A. Dorobantu, B. Mettler and G.J. Balas, "System Identification for Small, Low-Cost, Fixed-Wing Unmanned Aircraft," *AIAA Journal of Aircraft*, Vol. 50, No. 4, 2013, pp. 1117-1130.
10. A. Dorobantu, P. Seiler and G.J. Balas, "Time Delay Margin Analysis for an Adaptive Controller," *AIAA Journal of Guidance, Dynamics and Control*, Vol. 35, No. 5, pp. 1418-1425, Sept. 2012.
11. H. Mokhtarzadeh, G.J. Balas and R.E. Arndt, "Effect of Cavitator on Supercavitating Vehicle Dynamics," *IEEE Journal of Oceanic Engineering*, Vol. 37, No. 1, Feb. 2012.
12. R. Pandita, J. Bokor, and G.J. Balas, "Closed-loop Performance Metrics for Fault Detection and Isolation Filters," *International Journal of Robust and Nonlinear Control*, on-line. Dec. 2011.
13. A. Ozdemir, P. Seiler and G.J. Balas, "Performance of disturbance augmented control design in turbulent wind conditions", *Special Issue Mechatronics: Past, present and future modeling and control of wind turbines*, vol. 21, no. 4, pp. 634-644, June 2011.
14. A. Chakraborty, P. Seiler and G.J. Balas, "Nonlinear region of attraction analysis for flight control verification and validation," *IFAC Control Engineering Practice Journal*, vol. 19, issue 4, pp. 335-345, April 2011.
15. A. Chakraborty, P. Seiler and G.J. Balas, "Susceptibility of F/A-18 Flight Controllers to the Falling Leaf Mode: Linear Analysis," *AIAA Journal of Guidance, Dynamics and Control*, vol. 34, no. 1, pp. 57-72, January 2011.
16. A. Chakraborty, P. Seiler and G.J. Balas, "Susceptibility of F/A-18 Flight Controllers to the Falling Leaf Mode: Nonlinear Analysis," *AIAA Journal of Guidance, Dynamics and Control*, vol. 34, no. 1, pp. 73-85, January 2011.
17. B. Vanek, P. Seiler, G.J. Balas, and Jozsef Bokor, "Robust Model Matching for Geometric Fault Detection Filters: A Commercial Aircraft," *Automatic Control in Aerospace* (online journal), <http://www.aerospace.unibo.it/>, Dec. 2010.

18. Y.C. Paw and G.J. Balas, "Development and application of an integrated framework for small UAV flight control development," *Mechatronics*, Vol. 21, no. 5, August 2011, pp. 789-802
19. B. Vanek, G.J. Balas and R.E.A. Arndt, "Linear, parameter-varying control of a supercavitation vehicle," *Control Engineering Practice*, vol. 18, issue 9, pp. 1003-1012, September 2010.
20. A. Packard, U. Topcu, P. Seiler, and G. Balas, "Help on SOS," *IEEE Control System Magazine*, Vol. 30, No. 4, pp. 18-23, August 2010.
21. P. Seiler, A. Packard, and G.J. Balas, "A gain-based lower bound algorithm for real and mixed μ problems," *Automatica*, Vol. 46, No. 3, pp. 493-500, March 2010.
22. U. Topcu, A.K. Packard, P. Seiler, and G.J. Balas, "Robust Region-of-Attraction Estimation," *IEEE Transactions on Automatic Control*, Vol. 55, No. 1, pp. 137-141, January 2010.
23. P. Seiler, U. Topcu, A. Packard, and G. Balas, "Parameter-Dependent Lyapunov Functions for Linear Systems With Constant Uncertainties," *IEEE Trans. on Aut. Cont.*, Vol. 54, No. 10, pp. 2410-2416, 2009.
24. R. Bhattacharya and G.J. Balas, "Control in Computationally Constrained Environments," *IEEE Transactions on Control Systems Technology*, vol. 17, no. 3, May 2009, p. 589-99.
25. T. Keviczky, F. Borrelli, K. Fregene, D. Godbole and G.J. Balas, "Decentralized receding horizon control and coordination of autonomous vehicle formations," *IEEE Transactions on Control Systems Technology*, vol. 16, no. 1, 2008, p. 19-33.
26. B. Vanek, J. Bokor, G.J. Balas and R.E.A. Arndt, "Longitudinal motion control for a high-speed supercavitation vehicle," *Journal of Vibration and Control*, vol. 13, no. 2, 2007, p. 159-184.
27. T. Keviczky, F. Borrelli, K. Fregene, D. Godbole and G.J. Balas, "Decentralized receding horizon control for large scale dynamically decoupled systems," *Automatica*, vol. 42, no. 12, 2006, p. 2105-2115.
28. T. Keviczky and G.J. Balas, "Receding horizon control of an F-16 aircraft: A comparative study," *IFAC Control Engineering Practice*, vol. 14, no. 9, 2006, p. 1023-1034.
29. A. Marcos and G.J. Balas, "An Integrated control/diagnosis filter aircraft application," *International Journal of Robust and Nonlinear Control*, vol. 15, no. 12, 2005, p. 531 - 551.
30. R. Ingvalson, H. Rotstein, T. Keviczky and G.J. Balas, "Fault detection design for uninhabited aerial vehicles," *AIAA Journal of Guidance, Dynamics and Control*, vol. 29, no. 5, 2005, p. 1051-1060. June 2005.
31. T. Keviczky and G.J. Balas, "Software-enabled receding horizon control for autonomous UAV guidance," *AIAA Journal of Guidance, Dynamics and Control*, vol. 29, no. 3, 2005, p. 680-694.
32. R.E.A. Arndt, G.J. Balas and M. Wosnik, "Control of cavitating flows: A perspective," *Japan Society of Mechanical Engineers International Journal*, Japan, i vol. 48, no. 2, 2005 p. 334-341.
33. I. Szász, A. Marcos, G.J. Balas and J. Bokor, "LPV detection filter design for a Boeing 747-100/200 aircraft," *AIAA Journal of Guidance, Dynamics and Control*, vol. 28, no. 3, 2005, p. 461-470.
34. A. Marcos, S. Ganguli and G.J. Balas, "An Application of H_∞ fault detection and isolation to a transport aircraft," *IFAC Control Engineering Practice Journal*, vol. 13, no. 1, 2005, p. 105-119.
35. R. Bhattacharya and G.J. Balas, "Anytime control algorithm: A model reduction approach," *AIAA Journal of Guidance, Dynamics and Control*, vol. 27, no. 5, 2004, p. 767-776.
36. A. Marcos and G.J. Balas, "Development of linear parameter varying models for aircraft," *AIAA Journal of Guidance, Dynamics and Control*, vol. 27, no. 2, 2004, p. 218-228.

37. D.O. Philbrick, Z. Jarvis-Wloszak, M.A. Kaya, A.K. Packard and G.J. Balas, "Disturbance preview and on-line optimization to improve system performance," *IEEE Transactions on Automatic Control*, vol. 49, no. 2, 2004, pp. 266-270.
38. J. Bokor and G.J. Balas, "Detection filter design for LPV systems – A geometric approach," *Automatica*, vol. 40, pp. 511-518, March 2004.
39. G.J. Balas, J. Bokor and Z. Szabó, "Invariant subspaces for LPV systems and their applications," *IEEE Transactions on Automatic Control*, vol. 48, no. 11, pp. 2065-9, November 2003.
40. G.J. Balas, "Flight control law design: An industry perspective," *Fundamental Issues in Control, Special Issue, European Journal of Control*, vol. 9, no. 2-3, 2003, p. 207-226.
41. F. Wu, A.K. Packard and G.J. Balas, "Systematic gain-scheduling control design: A missile autopilot example," *Asian Journal of Control*, vol. 4, no. 3, 2002, p. 341-347.
42. J.Y. Shin and G.J. Balas, "Optimal blending functions in linear parameter varying control synthesis for the F-16 aircraft," *AIAA Journal of Guidance, Dynamics and Control*, vol. 25, no. 6, 2002, p. 1040-1048.
43. V. Nalbantoğlu, J. Bokor, G.J. Balas, "System identification with generalized orthonormal basis functions: an application to flexible structures," *IFAC Control Engineering Practice Journal*, vol. 11, issue 3, 2003, p. 245-259.
44. R. Bhattacharya, G.J. Balas, M.A. Kaya and A.K. Packard, "Nonlinear receding horizon control of the F-16 aircraft," *AIAA Journal of Guidance, Dynamics and Control*, vol. 25, no. 5, 2002, p. 924-931.
45. G.J. Balas, "Linear, parameter-varying control and its application to a turbofan engine," *International Journal of Robust and Nonlinear Control*, Special Issue on Gain-Scheduled Control, vol. 12, September 2002, p. 763-796.
46. I. Fialho and G.J. Balas, "Road adaptive active suspension design using linear parameter-varying gain-scheduling," *IEEE Transactions of Control Systems Technology*, vol. 10, no. 1, January 2002, pp. 43-54.
47. M. Karkoub, G.J. Balas, K. Tamma, and M. Donath, "Modeling and robust control of single-link robot arms," *IFAC Control Engineering Practice Journal*, vol. 8, no. 7, June 2000, p. 725-734.
48. J. Shin, G.J. Balas, and A.K. Packard, "Worst case analysis of the X-38 crew return vehicle flight control system," *AIAA Journal of Guidance, Dynamics and Control*, vol. 24, no. 2, March-April 2001, pp. 261-269.
49. W. Lu, G.J. Balas, and E.B. Lee, "Linear quadratic performance with worst case disturbance rejection," *International Journal of Control*, vol. 73, no. 16, Nov. 2000, pp. 1516-1524.
50. J. Barker and G.J. Balas, "Comparing linear parameter-varying gain-scheduled control techniques for active flutter suppression," *AIAA Journal of Guidance, Dynamics and Control*, Benchmark Active Control Technology Special Section, Part I, vol. 23, no. 5, Sep-Oct. 2000, pp. 948-955.
51. I. Fialho and G.J. Balas, "Design of nonlinear controllers for active vehicle suspensions using parameter-varying control synthesis," *Vehicle Systems Dynamics*, vol. 33, no. 5, May 2000, pp. 351-370.
52. M. Karkoub, K. Tamma and G. Balas, "Robust control of two-link flexible manipulators using the μ -synthesis technique," *ASME Journal of Vibration and Control*, June, 1999.
53. G. Wolodkin, G.J. Balas, W.L. Garrard, "Application of parameter-dependent robust control synthesis to turbofan engines," *AIAA Journal of Guidance, Dynamics and Control*, vol. 22, no. 6, 1999, pp. 833-838.
54. I. Fialho, G.J. Balas, A.K. Packard, J. Renfrow, and C. Mullaney, "Gain-scheduled lateral control of the F-14 aircraft during powered approach landing," *AIAA Journal of Guidance, Dynamics and Control*, vol. 23, no. 3, 2000, pp. 450-458.

55. G.J. Balas and P.M. Young, "Sensor selection via closed-loop control objectives," *IEEE Transactions of Control Systems Technology*, vol. 7, no. 6, November, 1999, pp. 692-705.
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94. R. Bhattacharya and G.J. Balas, "Implementation of control algorithms in an environment of dynamically scheduled CPU time," *AIAA Guidance, Navigation and Control Conference*, August 2002, AIAA-2002-4758.
95. I. Szaszi, A. Marcos, G.J. Balas and J. Bokor, "LPV detection filter design for Boeing 747-100/200," *American Control Conference*, Anchorage, AK, May 2002, pp. 4232-7.
96. A. Marcos, S. Ganguli and G.J. Balas, "An LPV fault detection and isolation application to the longitudinal motion of a Boeing 747-100/200," *AIAA Guidance, Navigation and Control Conference*, August 2002.
97. G.J. Balas, J. Bokor and Z. Szabo, "Failure detection for LPV systems: a geometric approach," *American Control Conference*, June 2002, pp. 4421-6.
98. S. Ganguli, A. Marcos, I. Szaszi, G.J. Balas and J. Bokor, "Application of FDI to a Nonlinear Boeing-747 Aircraft," *Mediterranean Control and Automation Conference*, July 2002.
99. J.Y. Shin and G.J. Balas, "Optimal blending functions in linear parameter varying control synthesis for the F-16 aircraft," *2002 American Control Conference*, Anchorage, AK, May 2002, pp. 41-46.

100. D.O. Philbrick, Z. Jarvis-Wloszak, M.A. Kaya, A.K. Packard and G.J. Balas, "Disturbance preview and on-line optimization to improve system performance," *2002 American Control Conference*, Anchorage, AK, May 2002, pp. 2037-43.
101. S. Ganguli, A. Marcos and G.J. Balas, "Reconfigurable LPV control design for the Boeing 747-100/200 longitudinal motion," *2002 American Control Conference*, Anchorage, AK, May 2002, pp. 3612-7.
102. G.J. Balas, J. Bokor and I. Szaszi, "Failure detection for LPV systems- a geometric approach," *2002 American Control Conference*, Anchorage, AK, May 2002, pp. 4421-6.
103. I. Szaszi, G.J. Balas and J. Bokor, "Design of FDI filter for an aircraft control system," *2002 American Control Conference*, Anchorage, AK, May 2002, pp. 4232-7.
104. S. Ganguli and G.J. Balas, "A TECS alternative using robust multivariable control," *AIAA Guidance, Navigation and Control Conference*, Montreal, Canada, August, 2001, AIAA 2001-4022.
105. A. Marcos and G.J. Balas, "Linear parameter varying modeling of the Boeing 747-100/200 longitudinal motion," *AIAA Guidance, Navigation and Control Conference*, Montreal, Canada, August, 2001, AIAA-2001-4347.
106. J. Bokor and G.J. Balas, "Detection filter design within the LPV framework," *Proceeding of 19th Digital Avionics Systems Conference*, Philadelphia, PA, October 2000, GA3/1-5, Volume 2.
107. S. Dassanayake, G.J. Balas and J. Bokor, "Using unknown input observers to detect and isolate sensor faults of a turbofan engine," *Proceeding of 19th Digital Avionics Systems Conference*, Philadelphia, PA, October 2000, GE5/1-7, Volume 2.
108. R. Bhattacharya, G.J. Balas, M.A. Kaya and A.K. Packard, "Nonlinear receding horizon control of F-16 aircraft," *2001 American Control Conference*, Alexandria, VA, June 2001, pp. 518-22.
109. G.J. Balas and J. Mueller, "Implementation and testing of LPV controllers for the NASA F/A-18 System Research Aircraft," *2000 AIAA Guidance, Navigation and Control Conference*, Denver, CO, Aug. 2000, AIAA-2000-4446.
110. G.J. Balas and J. Bokor, "Detection filter design for LPV systems," *Proceeding of SAFEPROCESS 2000*, Budapest, Hungary, pp. 653-656.
111. W. Tan, A.K. Packard and G.J. Balas, "Quasi-LPV modeling and LPV control of a generic missile," *2000 American Control Conference*, Chicago, IL, June, 2000, pp. 3692-3696.
112. A.K. Packard, G.J. Balas, R. Lui and J. Shin, "Results on worst-case performance assessment," *2000 American Control Conference*, Chicago, IL, June, 2000, pp. 2425-2427.
113. J. Shin, G.J. Balas and A.K. Packard, " H_∞ control of X-38 V132 lateral-directional axis," *2000 American Control Conference*, Chicago, IL, June, 2000, pp. 1862-1866.
114. C. van Etten, G.J. Balas, and S. Bennani, "Linear parameter-varying integrated flight and structural mode control for a flexible aircraft," *1999 AIAA Guidance, Navigation and Control Conference*, Portland, OR, Aug. 1999, AIAA-99-4217.
115. J. Shin, G.J. Balas, and A.K. Packard, "Worst case analysis of the flight control system X-38 crew return vehicle," *1999 AIAA Guidance, Navigation and Control Conference*, Portland, OR, Aug. 1999, AIAA-99-4052.
116. J. Barker and G.J. Balas, "Flight control of a tailless aircraft via linear parameter-varying techniques," *1999 AIAA Guidance, Navigation and Control Conference*, Portland, OR, Aug. 1999, AIAA-99-4133.
117. G.J. Balas and J. Mueller, "Application of gain-scheduled, multivariable control techniques to the F/A-18 System Research Aircraft," *1999 AIAA Guidance, Navigation and Control Conference*, Portland, OR, Aug. 1999, AIAA-99-4206.

118. S. Ganguli and G.J. Balas, "Application of robust control techniques to the ACTEX-I flight experiment," *1999 AIAA Guidance, Navigation and Control Conference*, Portland, OR, Aug. 1999, AIAA-99-3955.
119. J.M. Barker, G.J. Balas, and P.A. Blue, "Gain-scheduled linear fractional control for active flutter suppression," *1999 American Control Conference*, San Diego, CA, June, 1999.
120. G.J. Balas, A. Packard, E. Wemhoff, "Cone-bounded analysis of interconnections of identical, but uncertain Lipschitz nonlinearities," *1998 Conference on Control and Decision*, Tampa, FL, December, 1998.
121. G.J. Balas, J. Ryan, J.Y. Shin, and W.L. Garrard, "A New technique for design of controllers for turbofan engines," AIAA-98-3751, Session 95-ASME-21, *34th Joint Propulsion Conference*, Cleveland, OH, July, 1998.
122. G. Wolodkin, G.J. Balas, W.L. Garrard, "Application of Parameter-Dependent Robust Control Synthesis to Turbofan Engines," *36th AIAA Aerospace Sciences Meeting*, Reno, NV, January, 1998, AIAA-98-0973.
123. R. Lind, V. Nalbantoglu, and G.J. Balas, "Choosing sensor configuration for a flexible structure using full control synthesis," *1997 AIAA Guidance, Navigation and Control Conference*, New Orleans, LA, August, 1997.
124. P.A. Blue and G.J. Balas, "Linear parameter-varying control for active flutter suppression," *1997 AIAA Guidance, Navigation and Control Conference*, New Orleans, La., August, 1997.
125. G.J. Balas, "A flexible structure controls experiment," *1997 American Control Conference*, Albuquerque, NM, June, 1997.
126. G.J. Balas, I.J. Fialho, A.K. Packard, J. Renfrow, and C. Mullaney, "On the design of LPV controllers for the F-14 lateral-directional axis during powered approach," *1997 American Control Conference*, Albuquerque, NM, June, 1997, pp. 123-127.
127. I.J. Fialho, G.J. Balas, A.K. Packard, J. Renfrow, and C. Mullaney, "Linear fractional transformation control of the F-14 lateral-directional axis during powered approach," *1997 American Control Conference*, Albuquerque, NM, June, 1997, pp. 128-132.
128. G.J. Balas and A.K. Packard, "New advances in the μ analysis and synthesis toolbox," *2nd IFAC Symposium on Robust Control Design*, Budapest, HU, June, 1997.
129. V. Nalbantoglu, J. Bokor, and G.J. Balas, "System identification with orthonormal basis functions: An application to flexible structures," *2nd IFAC Symposium on Robust Control Design*, Budapest, HU, June, 1997.
130. G.J. Balas, "Synthesis of controllers for the active mass driver system in the presence of uncertainty," *ASCE Structures Congress XV* April 13-16, 1997.
131. K.B. Lim, D.E. Cox, G.J. Balas, and J-N. Juang, "Validation of an experimentally derived uncertainty model," the *AIAA General Meeting*, Reno, NV, January, 1997.
132. W. Lu, G.J. Balas and E.B. Lee, "A Rigorous approach to \mathcal{H}_∞ control with transients," *1996 Conference on Decision and Control*, Kobe, Japan, Dec. 1996, pp. 2344-2349.
133. K.B. Lim, G.J. Balas, and T.C. Anthony, "A minimum-norm model validation identification for robust control," *1996 AIAA Guidance, Navigation and Control Conference*, San Diego, CA, 1996, Paper No. AIAA-96-3717.
134. V. Nalbantoglu, G.J. Balas, and P. Thomson, "The role of performance criteria selection in the control of flexible structures," *1996 AIAA Guidance, Navigation and Control Conference*, San Diego, CA, 1996, Paper No. AIAA-96-3841.
135. G.J. Balas, A.K. Packard, B. McCloskey, J. Renfrow, and C. Mullaney, "Design of controllers for the F-14 aircraft lateral-directional axis during powered approach," *1996 AIAA Guidance, Navigation and Control Conference*, San Diego, CA, 1996, Paper No. AIAA-96-3781.

136. R. Lind and G.J. Balas, "Optimal full information synthesis for flexible structures implemented on Cray supercomputers," *1996 AIAA Guidance, Navigation and Control Conference*, San Diego, CA, 1996, Paper No. AIAA-96-3809.
137. P. Thomson, G.J. Balas, P.H. Leo, and V. Nalbantoglu, "Shape memory alloys for augmenting damping of flexible structures," *1996 AIAA Guidance, Navigation and Control Conference*, San Diego, CA, 1996, Paper No. AIAA-96-3760.
138. P. Thomson, G.J. Balas, and V. Nalbantoglu, "Benefits of passive SMA elements in active vibration control," *Proceedings of the First European Conference on Structural Control*, 29-31 May 1996, Barcelona, Spain.
139. W. Lu and G.J. Balas, "Robust, gain-scheduled control design of a lightly damped plant," *1995 Conference on Decision and Control*, Dec. 1995.
140. F. Wu, A.K. Packard, and G.J. Balas, "LPV control design for pitch-axis missile autopilots," *1995 Conference on Decision and Control*, Dec. 1995.
141. R. Lind, G.J. Balas, and A.K. Packard, "Robustness analysis with linear time-invariant and time-varying real uncertainty," *1995 AIAA Guidance, Navigation and Control Conference*, Paper # 95-3188, pp. 132-140, Baltimore, MD, Aug. 1995.
142. S. Hougui, G.J. Balas, and W. Garrard, "Design of a robust dynamic inversion lateral/directional flight controller," *1995 AIAA Guidance, Navigation and Control Conference*, Paper # 95-3253, pp. 738-749, Baltimore, MD, Aug. 1995.
143. A. Kumar and G.J. Balas, "A scaling approach to model validation in the μ -framework," *1995 American Control Conference*, pp. 693-697, June 1995.
144. R. Lind, G.J. Balas, and A.K. Packard, "Optimal scaled H_∞ FI synthesis with real parametric uncertainty," *1995 American Control Conference*, pp. 3463-3467, June 1995.
145. M. Karkoub, G.J. Balas, and K. Tamma, "Colocated and noncolocated control design via μ -synthesis for flexible manipulators," *1995 American Control Conference*, pp. 3321-3325, June 1995.
146. W. Lu, G.J. Balas, and E.B. Lee, "Linear quadratic performance with worst case disturbance rejection," *1995 American Control Conference*, pp. 1962-1966, June 1995.
147. A. Kumar, A. Tannenbaum, and G.J. Balas, "Optical flow: A curve evolution approach," *IEEE Int. Conf. on Image Processing*, vol. 3, pp. 17-20, 1995, Los Alamitos, CA.
148. W. Lu and G.J. Balas, "Hankel-like norm and its comparison with standard induced norm," *1995 IEEE Conference on Control and Decision*, Dec., 1994.
149. J. Reiner, G.J. Balas, and W. Garrard, "Design of a flight control system for a highly maneuverable aircraft using robust dynamic inversion," *1994 AIAA Guidance, Navigation and Control Conference*, Paper # 94-3682, pp. 1270-1280, Scottsdale, AZ, Aug. 1994.
150. A. Kumar and G.J. Balas, "An approach to model validation in the μ -framework," *1994 American Control Conference*, Baltimore, MD, pp. 3021-3026, June, 1994.
151. R. Lind, G.J. Balas, and A. Packard, "Evaluating $D - K$ iteration for control design," *1994 American Control Conference*, Baltimore, MD, pp. 2792-2797, June, 1994.
152. P. Thomson, G.J. Balas, and P.H. Leo, "Pseudoelastic hysteresis of shape memory wires for passive structural damping: Theory and experiments," *Passive Damping at Smart Structures and Materials '94 Conference*, Int. Society for Optical Engineering, pp. 188-199, Feb. 1994.

153. A. Packard, G. Becker, D. Philbrick, and G.J. Balas, "Control of Parameter-Dependent Systems: Applications to \mathcal{H}_∞ Gain-Scheduling," *Rockwell Conference on Aerospace Control*, Simi Valley, CA, May, 1993.
154. A. Packard, G. Becker, D. Philbrick, and G.J. Balas, "Robust performance of parameter-dependent linear systems," *1993 American Control Conference*, pp. 2795-2799, August 1993.
155. J. Reiner, G.J. Balas, and W. Garrard, "Design of a flight control system for a highly maneuverable aircraft using μ synthesis," *AIAA Guidance, Navigation and Control Conference*, Monterey, CA, Paper # 93-3776, pp. 710-719, August, 1993.
156. G.J. Balas and A.K. Packard, "Design of robust time-varying controllers for missile autopilots," *The 1st Conference on Control Applications*, Dayton, OH, September, 1992.
157. K. Lim and G.J. Balas, "Line-of-sight control of the CSI evolutionary model: μ control," *American Control Conference*, Chicago, pp. 1996-2000, June, 1992.
158. G.J. Balas, A. Packard, and J. Harduvel, "Application of μ -synthesis techniques to momentum management and attitude control of the Space Station," *AIAA Guidance, Navigation and Control Conference*, New Orleans, LA, Paper # 91-2662, pp. 565-575, August, 1991.
159. G.J. Balas, P.M. Young, and J.C. Doyle, "The process of control design for the NASA Langley Minimast structure," *American Control Conference*, Boston, June, 1991.
160. G.J. Balas, A. Packard and John Doyle, "Development of advanced control design software for researchers and engineers," *American Control Conference*, Boston, June, 1991.
161. G.J. Balas and J.C. Doyle, "Robustness and performance trade offs in control design for flexible structures," *29th IEEE CDC*, Honolulu, Hawaii, pp. 2999-3010, December, 1990.
162. G.J. Balas and J.C. Doyle, "Colocated versus noncolocated multivariable control for flexible structures," *American Control Conference*, San Diego, CA, pp. 1923-1928, May, 1990.
163. G.J. Balas, C.C. Chu and J.C. Doyle, "Vibration damping and robust control of the JPL/AFAL experiment using μ synthesis," *Proceedings of the 28th CDC*, Tampa, FL, December, 1989.
164. G.J. Balas and J.C. Doyle, "Identification for robust control of flexible structures," *American Control Conference*, Pittsburgh, PA, pp. 2566-2571, June, 1989.
165. G.J. Balas, M. Lukich, R.L. Dailey, and J.C. Doyle, "Robust control of the truss experiment," *AIAA Guidance, Navigation and Control Conference*, Minneapolis, August, 1988.
166. G.J. Balas and J.C. Doyle, "On the Caltech experimental large space structure," *American Control Conference*, Atlanta, pp. 1701-1702, June, 1988.
167. G.J. Balas and R. Shepherd, "Dynamics and control of a large deployable reflector," *25th Structures, Structural Dynamics and Materials Conference*, Orlando, 1985.

Professional Teaching

- | | |
|-----------------------|---|
| Co-Organizer/Lecturer | <i>Robust Control Short Course: Theory and Applications</i>
(with A. Packard and J. Doyle) |
| | Pasadena (1989) |
| | NASA Langley Research Center (1990) |

- Cambridge University, England (1990, 1991)
 Delft University, The Netherlands (1990, 1995)
 Minneapolis (1991, 1992, 1993, 1994)
 Caterpillar, Peoria (1995).
- Lecturer *Identification and Control of Linear Parameter-Varying Systems*
 Veldhoven, The Netherlands (2006).
- Organizer/Lecturer *Robust Control Short Course*
 ESI, Portland (2004).
- Organizer/Lecturer *Application of Robust Multivariable Control to Stability, Control Augmentation and Trajectory Tracking of Unmanned Space and Aerial Vehicles*
 CIRA - Centro Italiano Ricerche Aerospaziali, Capau Italy (2005).
- Organizer/Lecturer *Robust Control Analysis Short Course*
 EADS Deutschland GmbH, Muenchen, Germany (2005).
- Co-Organizer/Lecturer *Modern Robust Control Analysis and Modeling Techniques Applied to Aerospace Vehicles Short Course* (with A. Marcos)
 Universidad Nacional de Colombia, Bogota, Columbia (2009).
 Universidad del Valle, Cali, Columbia (2009).
- Co-Organizer/Lecturer *Advanced Multivariable Control for Space Systems Short Course*
 (with A. Packard and P. Seiler)
 European Space Agency, Noordwijk, The Netherlands (2011).
 European Space Agency, Noordwijk, The Netherlands (2012).
 European Space Agency, Noordwijk, The Netherlands (2014).
- Co-Organizer/
 Lecturer *Theory and Application of Linear Parameter Varying Control*
 (with Andy Packard)
 University of Minnesota (1997)
 American Control Conference, Albuquerque, NM (1997).
 NASA Langley Research Center, Hampton VA (1997).
- Organizer/Lecturer *Frequency Domain Process Analysis and Control*
 3M (1999).
- Co-Organizer *LFT-Based Methods for Integrated Modeling of Nonlinear Systems*
 (with K. Poolla, A. Packard, D. Fisher, M.Freed)
 American Control Conference, San Diego, CA (1999).
- Co-Organizer/Lecturer *Navigation, Guidance and Control for UAV Applications*
 (with D. Gebre-Egziabher and B.M. Mettler)
 4th Annual UAV Summit, IDGA, Washington, DC (2008).
- Co-Organizer/Lecturer *Quantitative Local Analysis of Nonlinear Systems using Sum-of-Squares Decompositions*

(with Andy Packard, Peter Seiler, Ufuk Topcku)

American Control Conference, St. Louis, MO (2009).
NASA Langley Research Center, Hampton VA (2009)

Co-Organizer/Lecturer *Robust Multivariable, Linear Parameter Varying Control and Nonlinear Analysis*
(with Andy Packard)
Defense Science Organization, Singapore (2012).

Software Products

Co-developer/
Author *μ Analysis and Synthesis Toolbox*
A multivariable control system software package for MATLAB, distributed worldwide by The MathWorks, Inc (1991-2004).

Co-developer/
Author *Robust Control Toolbox*
A multivariable control system software package for MATLAB, distributed worldwide by The MathWorks, Inc. (Upgraded and replaced the *μ Analysis and Synthesis Toolbox* in October 2004, 2001-present.)

Technical Service

Member Advisory Board, Computer and Automation Research Institute, Hungarian Academy of Science, 2010-present.

Program Chair American Control Conference, 2014.

Chair Aerospace Department Chairs Association, 2009-2011.

Chair Task Force on Outreach, IEEE Control System Society, 2011-present, (co-chair 2008-10).

Finance Chair American Control Conference, 2012.

Scientific Advisor Active Control for Flexible 2020 Aircraft, European Commission, Paris, 2009-2011.

Chair SAE Aerospace Control and Guidance Systems Committee, 2008–2010.

Associate Editor IFAC Control Engineering Practice, Jan. 2005–Dec. 2009.

External Evaluator Aerospace Engineering, Delft University of Technology, Nov 2008.

Member International Programme Committee, European Control Conference, August 23-26, 2009, Budapest, Hungary.

Program Chair IEEE International Conference on Control Applications, September 2008.

Member International Programme Committee, 11th Mini-Conference on Vehicle System Dynamics, Identification and Anomalies, Budapest, Hungary, 5-7 November, 2008.

Member International Programme Committee, Mediterranean Control and Automation Conference, June 25-27, 2008, Ajaccio, Corsica.

Chair Local Arrangements, American Control Conference, June 14-16, 2006, Minneapolis, MN.

Member International Programme Committee, 9th Mini-Conference on Vehicle System Dynamics, Identification and Anomalies, Budapest, Hungary, 2-4 November, 2006.

Member International Programme Committee, Mediterranean Control and Automation Conference, July 9-12, 2002, Instituto Superior Tecnico, Lisbon, Portugal.

Vice-Chair SAE Aerospace Control and Guidance Systems Committee, 2000–2008.

Member	International Programme Committee, 4 th IFAC Symposium on Fault Detection, Supervision and Safety for Technical Processes, Budapest, Hungary, 14-16, June, 2000.
Member	International Program Committee, 7 th Mini-Conference on Vehicle System Dynamics, Identification and Anomalies, Budapest, Hungary, 9-11 November, 2000.
Associate Editor	AIAA Journal of Guidance, Dynamics and Control, January, 1996 through December, 1998.
Vice-Chair	ASME Aerospace Systems Panel, 1991-1997.
Member	International Program Committee for the 2nd IFAC Symposium on Robust Control Design, Budapest, Hungary, June 25-27, 1997.
Member	Technical Program Committee for the SPIE Conference on Smart Structures and Materials - Mathematics, Modeling and Control, San Diego, 1998 and 1999.
Member	International Programmed Committee for the 6th Mini-Conference on Vehicle System Dynamics, Identification and Anomalies, Budapest, Hungary, 9-11 November, 1998.
Member	AIAA, ASME and IEEE
Specialist Referee	Hong Kong Research Grants Council (RGC) Science Foundation Ireland Technology Foundation STW, The Netherlands King Fahad University, Saudi Arabia
External Ph.D. Examiner	Aalborg University, Aalborg, Denmark, 2008, 2011 Delft Technical University, The Netherlands, 2001, 2008 University of Stuttgart, Germany Nanyang Technological University, Singapore, 2004, 2008 Universite Bordeaux I, France, 2009 Technische Universität München, Germany, 2013
Referee	AIAA Journal of Guidance, Dynamics and Control ASME Journal of Dynamic Systems, Measurements and Control IEEE Journal of Control System Technology IEEE Transactions on Automatic Control Control System Magazine Automatica IFAC Control Engineering Practice IEEE Journal of Magnetism IEE Proceedings of Control Theory and Applications ASCE Journal of Engineering Mechanics International Journal of Robust and Nonlinear Control International Journal of Adaptive Control and Signal Processing Journal of Process Control Journal of Smart Materials and Structures SIAM Journal of Control Systems and Control Letters Mechatronics

Consulting

6/89-present	MUSYN Inc. <ul style="list-style-type: none"> • Development of robust control software, design of flight controllers and missile autopilots.
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- Worked with the Naval Air Warfare Center, Patuxent River, MD to develop flight control laws for the F-14 aircraft.
 - Worked with Johns Hopkins University Applied Physics Laboratories, Laurel, MD, to design gain-scheduled missile autopilots.
 - Design of longitudinal axis flight controllers for the high speed research (HSR) program. This work is being done in conjunction with NASA Langley and Boeing.
 - Design of a longitudinal axis flight controller for the Gulfstream V aircraft. This work was performed as a subcontract to Lockheed Martin under AIMS SAFE.
 - Advanced control software development.
- 1/04-present Barron Associates Inc.
- Development of worst-case analysis tools for verification and validation of flight control software.
- 9/02-9/04 Alphatech
- Analysis of model predictive control for distributed control of autonomous vehicles.
- 3/03 Pratt and Whitney
- Member of external design review panel for F-135 engine team (JSF).
- 2/01-4/01 Honeywell International
- Analysis of centralized versus decentralized HVAC building control approaches, performance and robustness trade offs for the DARPA Immune Building program.
- 7/90-6/96 Caterpillar International
- Synthesis of slope-finish multivariable controllers for a back hoe excavator.
- 3/89-2/92 Johns Hopkins University Applied Physics Laboratories
- Analysis and design of missile autopilots for back-to-turn missiles.
- 12/88-2/93 McDonnell Douglas Astronautics Company
- Analysis and design of vibration attenuation and momentum/attitude controllers for the space station Freedom.
- 8/88-12/88 TRW
- Analysis and design of vibration attenuation controllers for a space based antenna structure.

University Service: University of Minnesota

- 8/09–12/13 Chair, Subcommittee on the Administrative Software Policy.
- 3/10–12/13 Member, Committee on Institutional Risk Tolerance
- 5/11–6/13 Member, Research Risk Advisory Committee
- 5/04–1/13 Chair, University Senate Subcommittee on Research Secrecy.
- 4/11–6/11 Member, Subcommittee on Open Access
- 9/09–5/10 Member, Graduate Education Academic Issues Work Group
- 9/09–4/10 Member, Graduate Education Academic Issues Work Group
- 7/05–7/09 Member, University Senate Faculty Consultative Committee.
- 7/07–6/09 Member, Provost's Dean Review Committee

7/07–6/08	Chair, University Senate Faculty Consultative Committee.
7/07–11/08	Member, University of Minnesota Copyright Procedures Draft Committee
7/07–6/08	Member, University of Minnesota Alumni Association
10/07–10/08	Member, Dean of the College of Liberal Arts Search Committee
8/06–6/07	Member, Provost's Department Chairs Leadership Program
9/04–6/07	Senator, University Senate
9/92–9/06	Member, Physical Sciences Policy and Review Council
9/05–7/06	Member, Administrative Task Force on People
9/05–6/06	Steering Committee Member, Provost's Academic Task Forces on Collaborative Research and Research Infrastructure
7/05–6/06	Member, Institute of Technology Consultative Committee.
9/05–3/06	Member, Provost's Academic Task Force on Graduate Reform: Student Support
3/04–6/05	Member, Committee on Revision of Outside Consulting and Commitments Policy.
8/02–7/05	Chair, University Senate Committee on Research.
8/02–7/05	Member (ex officio), University Senate Faculty Consultative Committee.
3/04–7/05	Member, Advisory Committee on Royalty Policy Implementation.
9/01–7/05	Member, University Senate Committee on Research.
1/05–6/05	Chair, Subcommittee of Coursework Only Master of Science Degree, Physical Sciences Policy and Review Council.
11/04–1/05	Member, Financing Graduate Education Task Force.
7/04–10/04	Member, Dean of the Graduate School Search Committee
1/04–9/04	Member, Vice President for Research Search Committee.
11/98–11/99	Chair, University Senate Committee on Faculty Affairs (SCFA) Benefits Subcommittee.
7/97–10/97	Member, Semester Conversion Review Committee for the Graduate School Policy and Review Council
11/96–11/99	Chair, Physical Sciences Policy and Review Council
6/96–6/99	Member, University Senate Committee on Faculty Affairs (SCFA)
6/96–6/98	SCFA Representative to the Academic Staff Advisory Committee (ASAC)
1/96–1/97	Member, University Graduate Fellowship Committee
10/96	Member, Committee to Review Graduate Student Rights and Responsibilities Document

Invited Seminars and Visits

June 2013	Automotive Research Centre, Széchenyi István University, Győr, Hungary.
November 2011	Science and Engineering of Cyber-Physical Systems, Schloss Dagstuhl, Wadern, Germany
September 2011	Technische Universität Hamburg-Harburg, Hamburg, Germany
September 2011	DLR, Munich, Germany
November 2010	Hungarian Academy of Science, Budapest, Hungary
October 2010	University of Wyoming, Laramie, WY.
October 2010	National Wind Technology Center, Boulder, Colorado

September 2009	Technical University of Delft, The Netherlands.
July 2009	Workshop on Uncertain Dynamical Systems, Hyogo, Japan.
November 2008	Technical University of Delft, The Netherlands.
May 2008	Aalborg University, Aalborg, Denmark.
January 2008	NASA Langley Research Center, Hampton, VA
June 2006	European Space Agency, Noordwijk, The Netherlands.
April 2006	<i>Control of Uncertain Systems: Modelling, Approximation and Design Workshop</i> , Cambridge University, England.
March 2006	SAE Aerospace Control and Guidance Systems Committee, Lake Tahoe, CA.
February 2006	<i>Control of Protein Conformation Workshop</i> , DARPA, Arlington, VA.
June 2005	<i>IFAC Robust Control Workshop</i> , Delft, The Netherlands
March 2005	University of Michigan, Ann Arbor, MI.
March 2005	SAE Aerospace Control and Guidance Systems Committee, Salt Lake City, UT.
February 2005	Università degli Studi del Sannio, Benevento, Italy.
February 2005	CIRA, National Italian Centre for Aerospace Research, Capua, Italy.
June 2004	Technical University of Delft, The Netherlands.
June 2004	External Ph.D. Examiner, Technical University of Delft, The Netherlands.
April 2004	Penn State University, State College, PA.
October 2003	University of Illinois, Champagne-Urbana, IL.
September 2003	Cambridge University, Cambridge, England
March 2002	University of Florida, Gainesville, FL
August 2001	Hungarian Academy of Science, Budapest, Hungary
June 2000	Technical University of Delft, The Netherlands
June 2000	University of Stuttgart, Germany
February 1999	NASA Langley Research Center, Hampton, VA
January 1999	Boeing, Houston, TX.
January 1999	NASA Johnson Space Center, Houston, TX
November 1998	University of Budapest, Hungary
November 1998	University of Stuttgart, Germany
April 1998	NASA Dryden Research Center, Edwards, CA
April 1998	University of Houston, Houston, TX
April 1998	University of Maryland, College Park, MD
November 1997	NASA Lewis Research Center
March 1997	Duke University, Durham, NC.
March 1997	NASA Langley Research Center
March 1997	SAE Aerospace Conference, Monterey, CA
November 1996	University of California, San Diego, CA
February 1996	Old Dominion University, Hampton, VA
February 1996	NASA Langley Research Center, Hampton, VA
February 1995	Naval Air Warfare Center, Patuxent River, MD
May 1994	Technical University of Delft, The Netherlands

May 1994	Hungarian Academy of Science, Budapest, Hungary
May 1994	Hungarian Computer and Automation Research Institute, Budapest, Hungary
March 1994	Caterpillar International, IL
Feb 1994	Hughes Aircraft Company, CA
April 1993	University of Texas, Austin
December 1992	University of Michigan, MI
January 1992	Johns Hopkins Applied Physics Laboratories, MD
November 1991	Honeywell Systems and Research Center, MN
October 1991	NASA Langley Research Center, VA
June 1990	University of Trondheim, Trondheim, Norway
March 1990	Honeywell Systems and Research Center, MN
November 1989	University of California, Irvine
August 1989	Caterpillar International, IL
March 1989	Johns Hopkins University Applied Physics Laboratories, MD
January 1989	McDonnell Douglas Astronautics Company, CA
October 1988	McDonnell Douglas Astronautics Company,CA

Internal University Funding and Awards

Agency	Topic and Date of Award	Amount
University of Minnesota	Grant-In-Aid Program, "Synthesis of robust control laws for flexible structures," July 1990–June 1991.	\$ 9,500
University of Minnesota	Grant-In-Aid Program, "Control of high angle-of-attack aircraft," July 1991–June 1992.	\$ 9,000
University of Minnesota	McKnight-Land Grant Professorship, June 1993–May 1995.	\$ 33,000
University of Minnesota	Office of International Relations, Jan. 2005.	\$ 500
University of Minnesota	Vice President for Research support for organizing 2006 American Control Conference in Minneapolis, MN.	\$ 4,000

Prior External Funding

Agency	Topic and Date of Award	Amount
NASA Langley	Control/Structure Interaction Group, NAG-1-1254, "Vibration attenuation of the NASA Langley evolutionary structure experiment using H_∞ and structured singular value (μ) robust multivariable control techniques," May 1991–April 1995.	\$ 160,000
NSF	Engineering Science in Electrical, Communications and Systems Engineering Research Initiation Award, ECS-9110254, "Development of a systematic approach to uncertainty modeling for robust control design," September 1991–January 1994.	\$ 70,000
NASA Langley	Aircraft Flight Dynamics and Control Division, "Feedback control laws for highly maneuverable aircraft," with W. Garrard, January 1992–January 1996.	\$ 213,249
NSF	Numerical Methods Division, "Realization and model reduction for very large, sparse systems," with D. Boley and Y. Saad, September 1994–August 1997.	\$ 180,000
NSF	Strategic Highway Research Program, "Robust structural control for hazard mitigation using probable and possible models," CMS-9503370, with J. Beck, W. Garrard, July 1995–June 1997.	\$ 125,000
AFOSR	Partnership for Research Excellence and Transition, subcontract from Caltech, "Robust nonlinear control theory with applications to aerospace vehicles," October, 1995–September, 2000, Caltech award \$ 2,500,000, funding from September 1995–August 2000.	\$ 415,000
3M	Gift for Basic Research, "Research on control of extruded web calipers," Feb. 1995–Feb. 1996.	\$ 15,000
NASA Langley	Controls Division, "Robust System Identification for Control," April 1996–Sept. 1997.	\$ 75,000
3M	Gift for Basic Research, "Research on control of extruded web calipers," Jan. 1997–Jan. 1998.	\$ 15,000
Par Systems	Gift for Basic Research, "Dual Drive Position Control Research," Jan. 1998–June 1998.	\$ 5,000
AFOSR	Augmentation Awards for Science and Engineering Research Training, "Application of linear parameter varying control methods to aerospace systems," June 1996–May 1999.	\$ 92,607

Prior External Funding cont'd

Agency	Topic and Date of Award	Amount
NASA Lewis	Aeropropulsion Base Research and Technology, "Robust nonlinear feedback control of aircraft propulsion systems," Nov. 1996–Oct. 1999, with W.L. Garrard.	\$ 226,384
NASA Johnson	Aeroscience and Flight Mechanics Division, "Analysis of the X-38 V132 flight control system in the presence of aerodynamic uncertainty," Oct. 1998–June 1999.	\$ 43,841
NASA Dryden	Flight Controls Division, "Application of gain-scheduled, multivariable control techniques to the F/A-18 system research aircraft," NAG-4-205, Jan. 1999–Mar. 2001.	\$ 85,000
NASA Langley	Flight Controls Division, "Application of Linear Parameter-Varying Techniques to Safety Critical Aircraft Flight Systems," July 1999–July 2003.	\$ 705,015
DARPA	Information Technology Office, "An Integrated, Multi-Layer Approach to Software-Enabled Mission Planning to Vehicle Control," Aug. 1999–Nov. 2004.	\$ 2,179,600
NASA Johnson	Aeroscience and Flight Mechanics Division, "Worst Case Analysis of the X-38 V201 Flight Control System," NAG 9-1222, Mar. 2000–Mar. 2001.	\$ 40,918
ONR	Code 333, "Stability and Control of Very High Speed Cavity-Running Bodies," Dec. 2000–Nov. 2008, with R.E.A. Arndt.	\$ 2,048,459
Honeywell	Gift for Basic Research, "Cooperative Control Research," Dec. 2002 –Dec. 2003, with Y. Zhao and D. Gebre-Egziabher.	\$ 30,000
Honeywell	"Coordination and Control of Multiple Autonomous Vehicles," May 2003 –May 2004.	\$ 71,000
NASA Langley	Flight Controls Division, "Application of Linear Parameter-Varying Techniques to Safety Critical Aircraft Flight Systems: Phase II," May 2003–May 2008.	\$ 610,795
Rockwell Collins	Gift for Basic Research, "Cooperative Communication and Control Research," Sept. 2003 – May 2004.	\$ 10,000
Honeywell	Gift for Basic Research, "Cooperative Control Research," Aug. 2004 –Dec. 2004, with Y. Zhao and D. Gebre-Egziabher.	\$ 25,000

Prior External Funding cont'd

Agency	Topic and Date of Award	Amount
National Instruments	Equipment Gift for Basic Research, Jan. 2005	\$ 13,885
ATK	Ordinance Systems, Gift for Basic Research, March. 2005	\$ 30,000
AFOSR	Controls Division, "Development of Analysis Tools for Certification of Flight Control Laws," subcontract from UC Berkeley, May 2005–Nov. 2008.	\$ 148,907
Eaton Corporation	Gift for Basic Research, March 2005	\$ 10,000
Honeywell	Controls Group, "Nonlinear Control for Autonomous Helicopters," Sept. 2004 –Jan. 2005	\$ 73,083
NSF	International Research and Education, Planning Visits and Workshops, "Real Time Control of Hybrid Systems: Design, Implementation, Verification, and Validation," July 2006–June 2008.	\$ 26,492
Honeywell	Gift for Basic Research, "Large Disturbance Control for Micro Air Vehicles," Dec. 2007 –Dec. 2008.	\$ 25,000
ONR	"A Time-Resolved Particle Image Velocimetry System: A First Step in Developing New Control Algorithms for Supercavitating Vehicles," Apr. 2007–Mar. 2008, with R.E.A. Arndt.	\$ 325,566
NSF	IGERT, "Risk Analysis for Introduced Species and Genotypes," Feb. 2007–Feb. 2012, with 15 other researchers.	\$ 3,086,497
NASA	Integrated Resilient Aircraft Control, "Analytical Validation Tools for Safety Critical Systems," Feb. 2008–Jan. 2011.	\$ 900,000
NASA	"Fault Diagnosis and Reliable Flight Envelope Assessment," subcontract from NIA, May 2008–Jan. 2011.	\$ 293,200
ONR	Code 333, "Stability and Control of Very High Speed Cavity-Running Bodies," Oct. 2008–Sept. 2011, with R.E.A. Arndt.	\$ 635,000
Honeywell	Automation and Control Solutions, "Control of Energy Systems," Jan. 2009–Dec. 2009	\$ 25,000
Lockheed Martin	Systems Engineering, "Open, Optimal Autopilot Design for Desert Hawk III Unmanned Aircraft System," Jan. 2009–Dec. 2009	\$ 50,000
IREE	"Improved Energy Production for Large Wind Turbines," May 2009–April 2010.	\$ 50,000

Prior External Funding cont'd

The Mathworks	“Design, Build, Simulate, Test and Fly Small Uninhabited Aerial Vehicles (UAVs),” May 2009–Apr 2010.	\$ 26,000
National Instruments	Equipment Gift for Basic Research, July 2009	\$ 26,875
DOE	“An Industry/Academe Consortium for Achieving 20% wind by 2030 through Cutting-Edge Research and Workforce Training,” 15 Jan. 2010 – 14 Jan. 2012, F. Sotiropoulos PI, 7 Co-PIs.	\$ 7,900,000
NASA STTR	“Robust Aeroservoelastic Control Utilizing Physics-Based Aerodynamic Sensing,” 1 Jan. 2011 – 31 Dec. 2011, subcontract from Tao Systems.	\$ 50,000
NASA SBIR	“Reduced Order Aeroservoelastic Models with Rigid Body Modes,” Mar 2012–Aug 2012, subcontract from Systems Technology Inc. (STI)	\$ 50,000

Current External Funding

NSF	“CPS: Medium: Embedded Fault Detection for Low-Cost, Safety-Critical Systems,” Oct. 2009–Sept. 2014 with P. Seiler, M. Heimdahl, A. Zhai and J. Srivastava.	\$ 1,500,000
IREE	“Design Tools for Multivariable Control of Large Wind Turbines,” Sept. 2011 – Aug. 2014, with P. Seiler.	\$ 278,600
ONR	Code 333, “Stability and Control of Very High Speed Cavity-Running Bodies,” Mar. 2012–Dec. 2014, with R.E.A. Arndt.	\$ 600,000
AFOSR	“A Merged IQC/SOS Theory for Analysis of Nonlinear Control Systems,” June 2012–May 2015, with P. Seiler and A. Packard.	\$ 450,000
NASA	“Robust Aeroservoelastic Control Utilizing Physics-Based Aerodynamic Sensing,” Jul 2012–Jun 2014, subcontract from Tao Systems Inc.	\$ 330,000
NSF	“CPS: Medium: Embedded Fault Detection for Low-Cost, Safety-Critical Systems: Software Reuse Venture Funds,” Oct. 2012–Sept. 2015 with P. Seiler.	\$ 300,000
NASA	“Analytical Validation Tools for Safety Critical Systems Under Loss-of-Control Conditions,” Feb. 2013–Jan. 2016, with P. Seiler and A. Packard.	\$ 1,059,842
NASA SBIR	“Reduced Order Aeroservoelastic Models with Rigid Body Modes,” Aug 2013–Jul 2015, subcontract from Systems Technology Inc. (STI).	\$ 125,000