Curriculum Vitae

JESSY W. GRIZZLE
University of Michigan

Department of Robotics
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Over 1.2M views

Research Interests

Autonomy of legged robots; analysis and feedback control of nonlinear systems; control of bipedal robot locomotion; formal methods for highly dynamics systems; hybrid electric vehicles; automotive powertrain control; nonlinear discrete-time systems.

Education

1984	NSF-NATO Postdoctoral Fellowship in Science, Laboratory of Signals and Systems, CNRS, Ecole Supèrieure d'Electricité, Paris, France. Subject: "Geometric Methods in Discrete-time Nonlinear Control." Advisor: M. Michel Fliess
1980–1983	Ph.D. in Electrical Engineering, The University of Texas at Austin, Austin, Texas. Thesis: "The Structure and Optimization of Nonlinear Control Systems Possessing Symmetries." Advisor: Professor Steven I. Marcus
1979–1980	M.S. in Engineering, The University of Texas at Austin, Austin, Texas. Thesis: "An Analysis of Centralized and Decentralized Control Strategies for Multiaccess Broadcast Networks." Advisor: Professor Steven I. Marcus
1975–1979	B.S. in Electrical Engineering, Oklahoma State University, Stillwater, Oklahoma. Report: "Modeling the Global Carbon Cycle." Advisor: Professor Robert J. Mulholland

Professional Experience

2022-present	Professor of Robotics
2016-2022	Director of the Michigan Robotics Institute
2014-present	Elmer G. Gilbert Distinguished University Professor
2013	Visiting Professor, EECS Dept., MIT, January through May

2007–present	Jerry W. and Carol L. Levin Professor of Engineering
9/94-present	Professor of Electrical Engineering and Computer Science, University of Michigan
9/05–5/06	Professeur Invité, Université Lyon-I, Claude Bernard, Lyon, France
5/03	Professeur Invité, Ecole Centrale, Nantes, France
9/98-2/99	Professeur Invité, Université Louis Pasteur, Strasbourg, France
5/94–6/94	Directeur de Recherche Associé, Laboratoire d'Automatique de Nantes, Ecole Centrale, Nantes, France, Visiting Professor
1/91–3/91	Directeur de Recherche Associé, Laboratoire des Signaux et Systèmes, SUPELEC, CNRS-ESE, Gif-sur-Yvette, France, Visiting Professor on a Poste Rouge
5/91–7/91	Visiting Professor, Dipartimento di Informatica e Sistemistica, L'Università di Roma, "La Sapienza", Rome, Italy
1990-2001	Director of the Control Systems Laboratory, Department of Electrical Engineering and Computer Science, University of Michigan
1990–1994	Associate Professor of Electrical Engineering and Computer Science, University of Michigan
1987–1990	Assistant Professor of Electrical Engineering and Computer Science, University of Michigan
Summers 1988–2010	Consultant to Ford Mo. Co., Dearborn, MI
Summers 1986–1987	Research Engineer, Ford Motor Co., Dearborn, MI
1985–1987	Assistant Professor, Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign
1985–1987	Research Assistant Professor, Coordinated Science Laboratory, University of Illinois
1984	Postdoc, Laboratoire des Signaux et Systèmes, SUPELEC, CNRS, France

Honors and Awards

2023	Kalman Best Paper Award from ASME
2023	North Campus Deans' MLK Spirit Award 2023
2021	Provost Teaching Innovation Prize for "Designing for Inclusivity Means Breaking the AP Calculus Stranglehold on Engineering (and maybe STEM in general)" with Chad Jenkins, Maani Ghaffari, and Dwayne Joseph.

2021	Certificate of Appreciation for Contributions to the NxtGen STEM Scholars Program, Michigan Louis Stokes Alliance for Minority Participation (MI-LSAMP).
2019	IEEE Transactions on Automation Science and Engineering, Googol Best New Application Paper Award, with Xiangru Xu, Aaron Ames, and Paulo Tabuada.
2019	Guinness Book of World Records: lowest temperature endured by a bipedal robot (-22C for 1 hour and 2 minutes); Yukai Gong, Ray Zhang, Bruce Huang, and Grant Gibson.
2019	Certificate of Appreciation for Advocacy of Disability Issues, U-M Council for Disability Concerns
2014	IEEE Transactions on Control Systems Technology (TCST) Outstanding Paper Award; with Daniel F. Opila, Xiaoyong Wang, Ryan McGee, R. Brent Gillespie, and Jeffrey A. Cook
2014	Elmer G. Gilbert Distinguished University Professor
2014	Eta Kappa Nu ECE Professor of the Year (teaching award)
2012	Bode Prize, IEEE Control Systems Society
2012	10 World-Changing Innovators, Popular Mechanics
2010	Fellow of IFAC, the International Federation of Automatic Control
2010	Attwood Award, the highest faculty achievement award conferred by the College of Engineering at the University of Michigan
2007	Endowed Professorship, Jerry W. and Carol L. Levin Professor of Engineering
2007	University of Michigan Distinguished Faculty Achievement Award
2006	Scientific American Top 50 (honors the top 50 outstanding leaders in science and technology over the past year)
2005	Discover Magazine Top 100 Science Stories of 2005 (for Rabbit)
2005	College of Engineering Research Excellence Award
2004	Tau Beta Pi Engineering Professor of the Year, UofM Chapter
2003	Control Systems Technology Award of the IEEE Control Systems Society for *the development of fuel-efficient and environmentally friendly automotive powertrains through innovative application of control theory*, with J. Cook and J. Sun
2002	George S. Axelby Award (best paper published in the *IEEE Transactions on Automatic Control*); with G. Abba and F. Plestan
2001-2003	Ford Innovation Award

1997	Fellow of the IEEE (for Contributions to the Theory and Practice of Nonlinear Control)
1993	Henry Russel Award, University of Michigan, given in recognition of distinguished scholarship and conspicuous ability as a teacher
1993	College of Engineering Teaching Award
1992	Vehicular Electronics Paper of the Year: "Individual Cylinder Air-Fuel Ratio Control with a Single EGO Sensor", with K.L. Dobbins and J.A. Cook, *IEEE Vehicular Technology Society*
1990	Senior Member of IEEE
1987	National Science Foundation Presidential Young Investigator Award
1984	North Atlantic Treaty Organization (NATO) Postdoctoral Fellowship in Science; research performed at the Laboratory of Signals and Systems, France, January through December
1983	Fulbright Grant (Full, to France), October 1983 to June 1984 (declined)
1984	Outstanding Dissertation Award, The University of Texas at Austin, May

Plenary and Keynote Addresses

2020	Plenary Panel Speaker, IFAC World Congress, July
2018	Keynote Address, Caltech Robotics Day, March
2017	Plenary Lecture, Midwestern Robotics Conference, April
2016	Keynote Address, UIUC Control Systems Laboratory Student Conference, February
2015	Plenary Lecture, IFAC Conference on Analysis and Design of Hybrid Systems, October
2014	Distinguished Lecture Series at ETH Zurich, Switzerland, May
2014	Distinguished Lecture at University of Toronto, Canada, April
2014	Plenary Speaker, Texas Systems Day, March
2013	Keynote Address, Maryland Robotics Day, College Park, USA, October
2012	Bode Lecture, IEEE Conference on Decision and Control, USA, December
2012	Keynote Speaker, Osteobiology Society, Minneapolis, USA, October
2012	Plenary Speaker, Climbing and Walking Robots Conference (CLAWAR), Johns Hopkins, USA
2010	Plenary Speaker, IFAC Nonlinear Control Conference (NOLCOS), Bologna, Italy, August

2009	Plenary Speaker, 4èmes Journées Nationales de la Robotique Humanoide, Nantes, France, May
2007	13th IEEE & IFAC International Conference on Methods and Models in Automation and Robotics, Szczecin, Poland, August
2004	Plenary Speaker, IEEE Conference on Decision and Control, Bahamas, December
2003	Plenary Speaker, Allerton Conference on Control, Communication and Computing, Illinois, October
2003	Keynote Address, American Society of Biomechanics Annual Meeting, Ohio, September
2001	Plenary Speaker, Super Mechano-Systems Symposium, Japan, November

Professional Activities

2019-2020	A Roadmap for US Robotics–From Internet to Robotics 2020 Edition
2016-present	I have remained active as a reviewer. Since becoming Director of Robotics, I've had to stop editorial commitments.
2015-2017	Awards Nominations Chair, IEEE Control Systems Society
2009-2012	Senior Editor, IEEE Transactions on Automatic Control
2006-2009	Associate Editor at Large, IEEE Transactions on Automatic Control
2003-2005	American Automatic Control Council Award Committee and Chairman of Ragazzini Education Award subcommittee
2002-2005	IEEE Control Systems Field Award Committee
2002-2005	Associate Editor of Automatica
2003	Workshop on the Modeling and Control of Bipedal Robots, IEEE Conf. Dec. & Control, Co-organized with Carlos Canudas-de-Wit
2003-2004	International Program Committee for First IFAC Symposium on *Advances in Automotive Control* - University of Salerno, Italy, April 19-23, 2004
2001-2006	Program Committee for Conférence Internationale Francophone d'Automatique
2001	Program Committee for 2001-IEEE Conference on Decision and Control
2000-2003	Chair of IEEE Control Systems Society Fellows Solicitation Committee
1999-2003	Vice-Chair of IEEE Control Systems Society Working Group on Automotive Control Systems
1997-2000	Board of Governors for the IEEE Control Systems Society

1995	International Program Committee for IFAC Conference on System Structure and Control
1992	Vice-Chairman for NOLCOS-92, IFAC Symposium on Nonlinear Control Systems Design
1992	Blue ribbon panel for Student Paper Contest, 30th IEEE Conference on Decision and Control
1990-1993	Associate Editor for IEEE Transactions on Automatic Control
1989-1993	Associate Editor for Systems and Control Letters
1989	Publications Chairman for 28th IEEE Conference on Decision and Control
1987	Program Committee for 1987-IEEE Conference on Decision and Control
1986	Selected by NSF to NSF Workshop on Future Directions in Control, Santa Clara, California
1985	Organizer and one of two main speakers for Pre-Allerton Tutorial Workshop on Nonlinear Systems, Oct. 1

Foreign Languages

French

Italian

Doctoral Students Graduated

1990	Sun-Tae Chung, "Digital Aspects of Nonlinear Synthesis Problems"
1992	Yongkyu Song, "Estimation and Control in Discrete-time Nonlinear Systems"
1993	Kenneth Butts, "Issues in the Implementation of Automotive Control Systems"
1994	Paul Moraal, "Nonlinear Observer Design: Theory and Applications to Automotive Control"
1996	Anna Stefanopoulou, "Modeling and Control of Advanced Technology Engines"
1996	Peter Hanish, "Phenomenological Modeling of Reactive Ion Etching for Real-time Feedback Control"
1996	Courtney Hanish, "Modeling and Automation of an Electron Cyclotron Resonance Source Etcher Using a Chlorine/Argon Plasma"
1996	Manish Chandhok, "Phenomenological Modeling of Plasma Generation for the Real-time Control of RIE Systems"

1998 Erich Brandt, "Modeling and Diagnostics of Three-Way Catalysts for Advanced Emissions Control Systems

2000 Craig Garvin, "Radio Frequency Based Sensors for Diagnostics and Control of Plasma-Assisted Mirco Manufacturing"

2000 Jun-Mo Kang, "Advanced Control for Fuel Economy and Emissions Improvement in Spark Ignition Engines"

2000 Hyun-Mog Park, "Real-Time Feedback Control and Fault Detection in Deep-Submicron Plasma Etch"

2002 Giovanni (Gian Piero) Fiengo, "Emissions Control for the Spark Ignition Internal Combustion Engine Equipped with Three-Way Catalytic Converter," 2001 [Primary advisor: Luigi Glielmo ; thesis completed at Università degil Studi di Napoli Federico II]

2002 Joseph J. Scillieri, "Limitations and Improvements in the Idle Speed Control of a Direct Injection Spark Ignition Engine," 2002 [Primary advisor: James S. Freudenberg]

2003 Eric Westervelt, "Toward a Coherent Framework for the Control of Planar Biped Locomotion"

2004 Chan-Chiao (Joe) Lin, "Modeling and Control Strategy Development for Hybrid Vehicles" [Primary advisor: Huei Peng]

2005 Jun Ho Choi, "Model-based Control and Analysis of Anthropomorphic Walking"

2006 Edward Dean Tate, Jr., "Techniques for Hybrid Electric Vehicle Controller Synthesis"

2007 Benjamin Morris, "Stabilizing Highly Dynamic Locomotion in Planar Bipedal Robots with Dimension Reducing Control"

2008 Ioannis Poulakakis, "Stabilizing Monopedal Robot Running: Reduction-by-Feedback and Compliant Hybrid Zero Dynamics,"

2010 Daniel F. Opila , "Incorporating Drivability Metrics into Optimal Energy Management Strategies for Hybrid Vehicles," [Co-advisor: Brent Gillespie]

2011 Koushil Sreenath , "Feedback Control of a Bipedal Walker and Runner with Compliance"

2012 Hae Won Park , "Control of a Bipedal Robot Walker on Rough Terrain"

2013 Alireza Ramezani, "Feedback Control Design for MARLO, a 3D-Bipedal Robot"

2015 Brian G Buss, "Systematic Controller Design for Dynamic 3D Bipedal Robot Walking"

2016 Brent Griffin, "Nonholonomic Virtual Constraints and Gait Optimization for Robust Robot Walking Control"

2016	Hamed Razavi, "Symmetry Method for Limit Cycle Walking of Legged Robots," [Co-advisors: Anthony Bloch and Christine Chevallereau]
2017	Petter Nilsson, "Correct-by-Construction Control Software Synthesis for High-Dimensional Systems," pettni@umich.edu [Primary Advisor: Necmiye Ozay]
2018	Oguz Daci "Hybrid Electric Powertrain Design and Control with Planetary Gear Sets for Performance and Fuel Economy," [Co-advisor: Huei Peng]
2018	Xingye (Dennis) Da, "Trajectory Optimization and Machine Learning to Design Feedback Controllers for Bipedal Robots with Provable Stability"
2018	Yuxiao Chen, "Correct-by-construction control synthesis for systems with disturbance and uncertainty," [Co-Advised with Huei Peng]
2019	Ross Hartley, "Contact-Aided State Estimation on Lie Groups for Legged Robot Mapping and Control" [Co-Advised with Asst. Res. Scientist Maani Ghaffari Jadidi]
2020	William Clark, "Invariant Measures, Geometry, and Control of Hybrid and Nonholonomic Dynamical Systems" advised by Tony Bloch and Jessy Grizzle; " [Primary advisor was Anthony Bloch, Mathematics Department]
2021	Lu Gan, "Semantic-Aware Robotic Mapping in Unknown, Loosely Structured Environments;" [co-advised with Ryan Eustice and Maani Ghaffar, Primary Advisor Maani Ghaffari].
2021	Omar Harib " Advances in Feedback Control for High-dimensional Bipedal Models "
2022	Yukai Gong, "Feedback Control of Highly Dynamic 3D Bipedal Locomotion"
2023	Bruce JK Huang, "Autonomous System for Legged Robots: From Calibration and Pose Estimation to CLF Reactive Motion Planning"
2023	Grant Gibson, "Terrain-Aware Bipedal Locomotion"
2024	Margaret Eva Mungai, "Towards a Fall-Tolerant Framework for Bipedal Robots"
2024	Oluwami (Wami) Dosunmu-Ogunbi, "Ascending New Heights: Enhancing Bipedal Robotic Locomotion through Stair Climbing"

Patents

1. JK Huang, Y Tan, LEE Dongmyeong, VR Desaraju, JW Grizzle, "Systems and Methods for Informable Multi-objective and Multi-direction Rapidly Exploring Random Tree Route Planning," US Patent No. 12,104,910, October 2024.

2. Alex Colvin, Richard Soltis, Jeffrey Cook, and Jessy Grizzle, "Control Approach For Use With Dual Mode Oxygen Sensor," U. S. Patent No. 7197866, April 2007.

3. Giovanni Fiengo, Jeffrey Cook, and Jessy Grizzle, "Control Of Oxygen Storage In A Catalytic Converter," U. S. Patent No. 6840036, January 2005.

4. Jessy Grizzle and Jing Sun, "Hybrid Operating Mode for DISI Engines," U. S. Patent No. 6,411,885, June 2002.

5. Jessy Grizzle, Ilya Kolmanovsky and Jing Sun, "Fuel Injection Method for an Internal Combustion Engine," U. S. Patent No. 6,393,832, May 2002.

6. Ilya Kolmanovsky, Jessy Grizzle, Jing Sun and John Russell,"Coordinated Control of Valve Timing During Mode Transitions of Direct Injection Stratified Charge Engine," U.S. Patent No. 6,378,484, April 2002.

7. Julia Buckland and Jessy Grizzle, "Engine/Vehicle Speed Control For Direct Injection Spark Ignition Engine Applications," U.S. Patent No. 6,349,700, February 2002. .

8. Jessy Grizzle and Jing Sun, "Direct Injection Engine System and Method," U. S. Patent No. 6,336,071, January 2002

9. Jessy Grizzle and Jing Sun, "Hybrid Operating Mode for DISI Engines," U. S. Patent No. 6,321,714, November, 2001.

10. Julia Buckland and Jessy Grizzle, "Rapid Transient Torque Management in DISI Engines," U. S. Patent No. 6,278,933 , August 2001.

11. Jessy Grizzle and Jing Sun, "Direct Injection Engine System and Method," U. S. Patent No. 6,244,242, June 2001.

12. Jing Sun and Jessy Grizzle, "Direct Injection Engine System," U. S. Patent No. 6,209,526, April 2001.

13. Jessy Grizzle and Jing Sun, "Idle Speed Control," U. S. Patent No. 5,630,394, May 1997.

14. Jessy Grizzle and Jeffrey Cook,"An Engine Controller with Air Meter Compensation," U. S. Patent No. 5,654,501, August 1997.

15. Jeffrey Cook and Jessy Grizzle, "Method and Apparatus for Air-Fuel Ratio and Torque Control for an Internal Combustion Engine," U. S. Patent No. 5,515,828, May 1996.

16. Julian LoRusso, Jeffrey Cook, Pete Szpak and Jessy Grizzle,"System using Time Resolved A/F Sensor to Equalize Cylinder to Cylinder Air/Fuel Ratios with Variable Valve Control," U. S. Patent No. 5,377,654, January 1995.

17. Jeffrey Cook and Jessy Grizzle, "Individual Cylinder Air/Fuel Ratio Control System," U. S. Patent No. 4,962,741, October 1990.

Books and Reports

1. Eric Westervelt, Jessy Grizzle, Christine Chevallereau, Jun Ho Choi, and Benjamin Morris, *Feedback Control of Dynamic Bipedal Robot Locomotion*, CRC Press, Boca Raton, June 2007, 503 pages.

2. Jessy Grizzle, *ROB 101: Notes for Computational Linear Algebra*, First Edition, August 2020, 282 pages. Open sourced. Latest version is always here: `https://robotics.umich.edu/academic-program/courses/online-courses/`.

3. Jessy Grizzle, *ROB 501: Mathematics for Robotics*, First Edition, March 2022, 142 pages. Open sourced. Latest version is always here: `https://robotics.umich.edu/academic-program/courses/online-courses/`.

4. Christensen H, Amato N, Yanco H, Mataric M, Choset H, Drobnis A, Goldberg K, Grizzle J, Hager G, Hollerbach J, Hutchinson S. A roadmap for us robotics–from internet to robotics 2020 edition. Foundations and Trends® in Robotics. 2021 Jul 25;8(4):307-424.

5. J.W. Grizzle, "ROB 201 Calculus for the Modern Engineer", First Edition, August 2024, Open-sourced December 2024 GitHub.

Book Chapters

6. P.E. Moraal, J.A. Cook, and J.W. Grizzle, "Modeling the Induction Process of an Automobile Engine," Control Problems in Industry, I. Lasiecka and B. Morton, Eds., Birkauser, 1994, pp. 253-270.

7. J.A. Cook, J.W. Grizzle and J. Sun, "Automotive Engine Control," The Control Handbook, CRC Press, W. Levine, Ed., 1996, pp. 1261-1274.

8. B. Morris, E. R. Westervelt, C. Chevallereau, G. Buche, and J. W. Grizzle, "Achieving Bipedal Running with RABBIT: Six Steps toward Infinity," Fast Motions in Biomechanics and Robotics Symposium, Heidelberg, September 7 - 9, 2005. Republished as a book chapter in: Fast Motions in Biomechanics and Robotics: Optimization and Feedback Control (Springer Lecture Notes in Control and Information Sciences), pp. 277-297, November 13, 2006.

9. J.W. Grizzle and E.R. Westervelt, "Hybrid Zero Dynamics of Planar Bipedal Walking," Analysis and Design of Nonlinear Control Systems, Springer, Ed., A. Astolfi and L Marconi, pp. 223-237, 2008.

10. J. W. Grizzle, Christine Chevallereau, "Virtual Constraints and Hybrid Zero Dynamics for Realizing Underactuated Bipedal Locomotion," In: Goswami A., Vadakkepat P. (eds) Humanoid Robotics: A Reference. Springer, Dordrecht, 2017.

Journal Publications

11. J. W. Grizzle, K. Hsu, and S. I. Marcus, "A Decentralized Control Strategy for Multiaccess Broadcast Networks," *Large Scale Systems*, Vol. 3, May 1982, pp. 75-88.

12. J. W. Grizzle and S. I. Marcus, "Optimal Control of Systems Possessing Symmetries," *IEEE Trans. on Automatic Control*, Vol. AC-29, No. 11, November 1984, pp. 1037-1040.

13. J. W. Grizzle and S. I. Marcus, "The Structure of Nonlinear Control Systems Possessing Symmetries," *IEEE Trans. on Automatic Control*, Vol. AC-30, No. 3, pp. 248-258, March 1985.

14. J. W. Grizzle, "Distributions Invariantes Commandees pour les Systemes Non Lineaires en Temps Discret," *C. R. Acad. Sc. Paris, t. 300*, Serie I, no. 13, pp. 447-450, 1985.

15. J. W. Grizzle, "Controlled Invariance for Discrete Time Nonlinear Systems with an Application to the Disturbance Decoupling Problem," *IEEE Trans. on Automatic Control*, Vol. AC-30, No. 9, pp. 868-874, September 1985.

16. J. W. Grizzle and H. Nijmeijer, "Zeros at Infinity for Nonlinear Discrete Time Systems," *Math. System Theory*, 19, pp. 79-93, 1986.

17. J. W. Grizzle, "Local Input-Output Decoupling of Discrete Time Nonlinear Systems," *Int. J. of Control*, Vol 43, No. 5, pp. 1517-1530, 1986.

18. B. K. Powell, J. A. Cook and J. W. Grizzle, "Modelling and Analysis of an Inherently Multi-Rate Sampling Fuel Injected Engine Idle Speed Control Loop," *J. of Dym. Syst.*,Vol. 109, pp. 405-410,December 1987.

19. J. W. Grizzle and M. H. Shor, "Sampling, Infinite Zeros and Decoupling of Linear Systems," *Automatica*, Vol. 24, No. 3,pp. 387-396, May 1988.

20. J. W. Grizzle and P. V. Kokotovic, "Feedback Linearization of Sampled- Data Systems," *IEEE Trans. Automatic Control*,Vol. AC-33, No. 9,pp. 857-859, September 1988

21. C. H. Moog and J. W. Grizzle, "Decouplage Non Lineaire vu de l'Algebre Lineaire", *C. R. Acad. Sc. Paris, t. 300*, Serie I,pp. 497-500, September 1988.

22. A. Isidori and J. W. Grizzle, "Fixed Modes and Nonlinear Noninteracting Control with Stability," *IEEE Trans. Automatic Control*, Vol. 33, No. 10, pp. 907-914, October 1988.

23. J. W. Grizzle and A. Isidori, "Block Noninteracting Control with Stability via Static State Feedback", *Mathematics of Control, Signals, and Systems*, Vol. 2, 1989, pp. 315-341.

24. M. D. Di Benedetto, J. W. Grizzle and C. H. Moog, "Rank Invariants of Nonlinear Systems", *SIAM J. Control*, Vol. 27, No. 3, May 1989, pp. 658-672.

25. J. Freudenberg and J. W. Grizzle, "An Observation on the Parametrization of Causal Stable Controllers for Lifted Systems", *Control Theory and Advanced Technology*, Vol. 5, No. 3, September 1989, pp. 367-372.

26. S. T. Chung and J. W. Grizzle, "Sampled-Data Observer Error Linearization", *Automatica*, Vol. 26, No. 6, November, 1990, pp. 997-1007.

27. M. D. Di Benedetto and J. W. Grizzle, "An Intrinsic Notion of Regularity for Output Nulling, Inversion, and Dynamic Extension" *Control Theory and Advanced Technology*, vol. 6, No. 3, September 1990. pp. 357-381.

28. J.W. Grizzle, K. Dobbins and J. Cook, "Individual cylinder air-fuel ratio control with a single EGO sensor", *IEEE Transactions on Vehicular Technology*, Vol. 40, No. 1, February 1991, pp. 280-286.

29. J.W. Grizzle, M.D. Di Benedetto, "Approximation by Regular Input-Output Maps", *IEEE Trans. on Auto. Control*, Vol. AC-37, No. 7, July 1992, pp. 1052-1055.

30. S.T. Chung and J.W. Grizzle, "Nonlinear discrete-time block noninteracting control with internal exponential stability", *Int. J. Control.*, Vol. 55, No. 5, 1992, pp. 1071-1092.

31. J.W. Grizzle, "A Linear Algebraic Framework for the Analysis of Discrete-time Nonlinear Systems," *SIAM J. Control*, Vol. 31, No. 4, July 1993, pp. 1026-1044.

32. L. Benvenuti, M. Di Benedetto and J.W. Grizzle, "Approximate Output Tracking for Nonlinear Non-Minimum Phase Systems with an Application to Flight Control," *Journal of Robust and Non-linear Control*, Vol. 4, 1994, pp. 397-414.

33. M. Di Benedetto and J.W. Grizzle, "Asymptotic and Exact Model Matching for Nonlinear Systems," *IEEE Trans. Auto. Control*, Vol. 39, No. 8, pp. 1539-1550.

34. J.W. Grizzle, M. Di Benedetto and F. Lamnabhi-Lagarrigue, "Necessary Conditions for Asymptotic Tracking in Nonlinear Systems," *IEEE Trans. Auto. Control*, Vol. 39, No. 9, September 1994, pp. 1782-1794.

35. Y. Song and J.W. Grizzle, "The Extended Kalman Filter as a Local Asymptotic Observer for Nonlinear Discrete-Time Systems," *Journal of Mathematical Systems, Estimation and Control*, Vol. 5, No. 1, 1995, pp. 59-78.

36. P.E. Moraal and J.W. Grizzle, "Observer Design for Nonlinear Systems with Discrete-time Measurements", *IEEE Trans. Auto. Control*, Vol. 40, No. 3, March 1995, pp. 395-404.

37. P.D. Hanish, J.W. Grizzle, M.D. Giles and F.L. Terry, Jr., "A Model-Based Technique for Real-Time Estimation of Absolute Fluorine Concentration in a CF4/Ar Plasma", *Journal American Vacuum Science and Technology*, **B**, Vol. 13, No.3, May 1995, pp. 1802-1807.

38. B.A. Rashap, M. Elta, H. Etemad, J.P. Fournier, J.S. Freudenberg, M.D. Giles, J.W. Grizzle, P.T. Kabamba, P.P. Khargonekar, S. Lafortune, S.M. Meerkov, J.R. Moyne, D. Teneketzis, and F.L. Terry, Jr., "Control of Semiconductor Manufacturing Equipment: Reactive Ion Etching," *IEEE Transactions on Semiconductor Manufacturing*, Vol. 8, No.3, August 1995, pp. 286-297.

39. T.E. Benson, C.K. Hanish, P.D. Hanish, L.I. Kamlet, P. Klimecky, B.A. Rashap, J.S. Freudenberg, J.W. Grizzle, P.P. Khargonekar, F.L. Terry, Jr., and Bryan Barney, "Sensor Systems for Real-Time Feedback Control of Reactive-Ion Etching", *Journal American Vacuum Science and Technology*, **B**, January/February 1996, pp. 483-488.

40. S. Thomas III, H. H. Chen, C. K. Hanish, J. W. Grizzle, and S. W. Pang, "Minimized Response Time of Optical Emission and Mass Spectrometric Signals for Optimized Endpoint Detection," *Journal American Vacuum Science and Technology*, **B**, Jul/Aug 1996, pp. 2531-2536.

41. C. K. Hanish and J.W. Grizzle, "Automated Tuning of an Electron Cyclotron Resonance Cavity to a Microwave Power Source", *Journal American Vacuum Science and Technology*, **A**, 15(5), Sep/Oct 1997, pp. 2717-2727.

42. C. K. Hanish, J.W. Grizzle, H.-H Chen, L. I. Kamlet, S. Thomas III, F. L. Terry, Jr., and S. W. Pang, "Modeling and Algorithm Development for Automated Optical Endpointing of an HBT Emitter Etch," *Journal of Electronic Materials*, Vol. 26, No. 12, 1997, pp. 1401-1408.

43. A.G. Stefanopoulou, J. A. Cook, J. S.Freudenberg, and J. W. Grizzle, "Control-Oriented Model of a Dual Equal Variable Cam Timing Spark Ignition Engine," *ASME Journal of Dynamic Systems, Measurement, and Control*, vol. 120, 1998,pp. 257-266.

44. C. Garvin, B.E. Gilchrist, D.S. Grimard, and J.W. Grizzle, "Measurement and Error Evaluation of Electrical Parameters at Plasma Relevant Frequencies and Impedances," *Journal American Vacuum Science and Technology*, **A**, Vol. 16, No. 2 Mar/Apr 1998, pp. 595-606.

45. M. Chandhok and J.W. Grizzle, "Modeling the Pressure Dependence of DC Bias Voltage in Asymmetric, Capacitive RF Sheaths," *IEEE Trans. on Plasma Science*, Vol. 26, No. 2, April 1988, pp. 181-189.

46. H. M. Park, C. Garvin, D.S. Grimard, and J. W. Grizzle, "Control of Ion Energy in a Capacitively Coupled Reactive Ion Etcher," *Journal of the Electrochemical Society*, Vol. 145, NO. 12 Dec 1998, pp. 4247-4252.

47. C. Garvin, D. S. Grimard and J. W. Grizzle, "Advances in Broad Band RF Sensing for Real-Time Control of Plasma-Based Semiconductor Processing." *Journal of Vacuum Science and Technology A*, Volume 17, Number 4 Jul/Aug 1999, pp 1377-1383.

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