

**Jay Allen Farrell**

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- EMPLOYMENT UNIVERSITY OF CALIFORNIA AT RIVERSIDE
- Professor, Electrical Engineering July 2001 – present  
 Chair of Electrical Engineering Department July 1998 – June 2001  
 Associate Professor, Electrical Engineering July 1997 – June 2001  
 Assistant Professor, Electrical Engineering Jan. 1994 – June 1997
- Intelligent Vehicles. The objective of this research program is to develop the advanced navigation, control, and planning technologies necessary to support intelligent vehicle deployment. Support of this research includes: ONR and DARPA -- guidance and planning algorithms for chemical plume tracing; PATH & CALTRANS – centimeter accuracy vehicle; NSF – On-line approximation based control.
- CHARLES STARK DRAPER LABORATORY
- Senior Member of Technical Staff June 1989 - January 1994
- Planning, Situation Assessment, and Control for Autonomous Vehicles. This research combined robust estimation and control, adaptive and learning control, and artificial intelligence techniques to develop the perception, reasoning, and actuation capabilities required to support reliable, extended autonomous vehicle operation.
- Connectionist Learning Control Systems. This research developed the theory for and demonstrated applications of *learning control systems* as a method to accommodate modeling uncertainty in nonlinear dynamic systems. The research developed improved learning algorithms, alternative function approximation networks, and new learning control architectures.
- Charles Stark Draper Laboratory Recognition Award  
 For outstanding performance and achievement (May 1991).  
 For outstanding performance and achievement (Sept 1993).
- Engineering Vice Presidents Annual Award for Best Technical Publication: 1990  
 "Connectionist Learning Systems for Control," *SPIE OE/Boston '90*.
- EDUCATION UNIVERSITY OF NOTRE DAME Notre Dame, IN 46556
- Doctor of Philosophy, Electrical Engineering May 1989  
 Major Area: Systems and Applied Mathematics  
 Minor Area: Mathematics
- Master of Science, Electrical Engineering December 1987
- IOWA STATE UNIVERSITY Ames, IA 50010
- Bachelor of Science, Electrical Engineering May 1986  
 Degree Conferred With Distinction
- Bachelor of Science, Physics May 1986  
 Degree Conferred With Distinction
- UNDERGRADUATE TEACHING – Dynamics, Control, Simulation, Linear Algebra, Circuits  
 GRADUATE TEACHING – Nonlinear Systems, Estimation, Linear Systems, Stochastic Processes

## PROFESSIONAL ACTIVITY AND UNIVERSITY SERVICE (SELECTED)

### Professional Activity:

Associate Editor	IEEE Transactions on Neural Networks	1991 – 1994
Program Comm.	1993 IEEE International Symp. on Intelligent Control	1992 – 1993
Program Comm.	1994 IEEE International Symp. on Intelligent Control	1993 – 1994
Associate Editor	1994 IEEE Conference on Decision & Control	1993 – 1994
Financial Chair	1995 IEEE Conference on Decision & Control	1993 – 1996
Program Chair	1996 IEEE Int. Symp. on Intelligent Control	1994 – 1996
Member	IEEE Control Systems Conference Editorial Board	1994 – 1997
IEEE Control Systems	Representative on IEEE Neural Networks Council	1995 – 1998
Local Arrangem. Chair	1997 IEEE Conference on Decision and Control	1996 – 1997
Member	IEEE Control Systems TC on Intelligent Control	1997 – present
Associate Editor	IEEE Transactions on Automatic Control	1998 – 1999
Program Comm.	2000 IEEE International Symp. on Intelligent Control	2000
Program Comm.	2000 American Control Conference	2000
Financial Chair	2001 IEEE Conference on Decision & Control	1999 – 2002
Program Comm.	2001 IEEE International Symp. on Intelligent Control	2001
Financial Chair	2003 IEEE Conference on Decision & Control	2000 – 2004
Member	IEEE Control Systems Society Board of Governors	2003 – 2006
Program Comm.	2005 IEEE International Symp. on Intelligent Control	2005
Vice President, Finance	IEEE Control Systems Society	2005 – present

### Reviewer:

ASME Journal of Dynamic Systems, Measurement and Control,	Automatica,
ASME J. of Applied Mechanics,	Transportation Research Board,
IEEE Trans. Intelligent Transportation Systems,	Environmental Fluid Mechanics,
IEEE Trans. Automatic Control,	IEEE Control Systems Magazine
IEEE Trans. Control Systems Technology,	J. of Optimal Control
IEEE Trans. Neural Networks,	IEEE Trans. Circuits and Systems
IEEE Trans. Robotics and Automation,	Neurocomputing Letters
IEEE Trans. Systems, Man, and Cybernetics,	California PATH <sup>1</sup> Program,
	NSF

### University Service:

Chair of Department of Electrical Engineering, 98/99, 99/00, 00/01  
 Undergraduate Advisor and Chair of the Undergraduate Committee for the Electrical Engineering Department, 01/02 and 02/03.  
 Member of Mechanical Engineering Search Committee 2002-2003  
 Member of College of Engineering Committee to Review General Education Requirements 2002-2003  
 Chair of one Promotion Review Ad-hoc Committee 2002-2003  
 Member of UCR Graduate Awards Committee 2002-2003  
 UCR Committee on Academic Personnel 2003-2004, 2004-2005, 2005-2006

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<sup>1</sup> Partners for Advanced Transit and Highways

**GRANT ACTIVITY TABLE (Total = \$2,655,986)**

<u>Agency</u>	<u>Title</u>	<u>Amount</u>	<u>Period</u>	<u>PI Status</u>	<u>Status</u>
SC-AQMD (AB2766)	“Hydrogen Powered Advanced Hybrid Electric Vehicle” (with Co-PI Matt Barth)	\$637,284	6/28/96- 12/28/97	P.I.	Closed
PATH	“GSP/INS-Based Lateral and Longitudinal Control Demonstration” (with Co-PI Matt Barth)	\$40,937	10/1/96- 9/30/97	P.I.	Closed
PATH	“Integration of GPS-aided INS into AVCSS” (with Co-PI Matt Barth)	\$104,923	9/98-9/00	P.I.	Closed
PATH	“Differential Global Position/Inertial Navigation Systems (DDGPS/INS) for Advanced Vehicle Control” (with Co-PI Matt Barth)	\$50,000	10/1/98- 6/30/99	P.I.	Closed
ISE Research	“ICE Instrumentation and Control” (with Co-PI Matt Barth)	\$10,000	1/197- 6/30/97	P.I.	Closed
UCLA/NASA	“GPS/INS for SPFF Flight Control”	\$24,750	3/1/97- 9/30/97	P.I.	Closed
UCLA/NASA	“GPS/INS for SPFF Flight Control”	\$25,000	10/1/97- 9/30/98	P.I.	Closed
California Department of Transportation	“Construction of the California Speedway Test Track and On-Site Laboratory” (with PI Matt Barth)	\$125,000	8/98-9/00	Co-P.I.	Closed
ONR	“Chemical Plume Tracing” (Funding reflects Jay Farrell’s Portion) (with PI Ring Carde)	\$109,922 \$106,479	8/1/98- 7/31/99 8/1/99- 12/31/00	Co-P.I.	Closed Closed
PATH	“Integration of GPS/INS and Magnetic Markers for Advanced Vehicle Control” (with Co-PI Matt Barth)	\$38,494 \$79,455	11/1/99- 6/30/00 7/1/00- 6/30/01	P.I.	Closed Closed
ONR	“Chemical Plume Tracing” (Funding reflects Jay Farrell’s Portion) (with PI Ring Carde)	\$57,000	7/1/00- 12/31/00	Co-P.I.	Closed
PATH	Magnetometer/GPS/INS Demo 2002 Support and Rapid Integer Ambiguity Resolution Research	\$193,889	7/1/01- 12/30/03	P.I.	Closed
CALTRANS	Carrier Phase Differential GPS aided INS for Snowplow Guidance	\$228,000	9/30/02- 9/30/04	P.I.	Closed
ONR	Chemical Plume Tracing	\$365,185	7/1/01- 6/30/04	P.I.	Closed
CALTRANS	Carrier Phase Differential GPS aided INS for Snowplow Guidance	\$237,000	1/1/04- 10/1/06	P.I.	Current
NSF	Stability and Performance Guarantees for Self-Organizing On-line Approximation Based Control	\$222,668	7/1/03- 6/30/06	P.I.	Current

## Bibliography of Publications

### a. Books

1. J.A. Farrell, M. Barth, "The Global Positioning System and Inertial Navigation: Theory and Practice," , seven chapters, New York: McGraw-Hill Publishing, 370 pp, 1999.
2. J. A. Farrell, M. M. Polycarpou. "Adaptive Approximation Based Control: Unifying Neural, Fuzzy and Traditional Adaptive Approximation Approaches", John Wiley, 436 pp., 8 chapters, 2006.

### b. Journal Articles

1. A.N. Michel, J.A. Farrell, W. Porod, "Qualitative analysis of neural networks. Information and Decision Technologies," *IEEE Trans. Circuits & Syst.*, vol. 14, no. 3, pp. 169-194, 1988.
2. A.N. Michel, J.A. Farrell, W. Porod, "Qualitative analysis of neural networks," *IEEE Trans. Circuits & Syst.*, vol. 36, pp. 229-243, 1989.
3. R.K. Miller, A.N. Michel, J.A. Farrell, "Quantizer effects on steady-state error specifications of digital feedback control systems," *IEEE Trans. Automat. Contr.*, vol. 34, pp. 651-654, 1989.
4. J.A. Farrell, A.N. Michel, "Estimates of asymptotic trajectory bounds in digital implementations of linear feedback control systems," *IEEE Trans. Automat. Contr.*, vol 34, pp. 1319-1324, 1989.
5. A.N. Michel, J.A. Farrell, "Associative memories via artificial neural networks," *IEEE Contr. Syst. Mag.*, vol. 10, no. 3, pp. 6-17, 1990.
6. A.N. Michel, J.A. Farrell, H.F. Sun, "Analysis and synthesis techniques for Hopfield type synchronous discrete time neural networks with application to associative memory," *IEEE Trans. Circuits & Syst.*, vol. 37, pp. 1356-1366, 1990.
7. J.A. Farrell, A.N. Michel, "A synthesis procedure for Hopfield's continuous-time associative memory," *IEEE Trans. Circuits & Syst.*, 37, pp. 877-884, 1990.
8. J. Farrell, T. Berger, B. Appleby, "Using learning techniques to accommodate unanticipated faults," *IEEE Contr. Syst. Mag., Special Issue on Intelligent Control, June*, vol 13, no. 3, pp. 40-49, 1993.
9. J. Farrell, B. Clauberg, "Issues in the implementation of an indirect adaptive control system," *IEEE J. Oceanic Eng.*, vol. 18, pp. 311-318, 1993.
10. M.M. Livstone, J.A. Farrell, M.A. Dahleh, "Comments on least squares methods for  $H_\infty$  control oriented system identification," *IEEE Trans. Automat. Contr.*, vol. 39, p. 1531, 1994.
11. J. Farrell, M. Livstone, "Calculation of discrete-time process noise statistics for hybrid continuous/discrete-time applications," *Optimal Control: Application and Methods*, vol. 17, no. 2, pp. 151-155, 1996.
12. J.A. Farrell, "Motivations for local approximators in passive learning control," *Journal of Intelligent Systems and Control*, vol. 1, no. 2, pp. 195-210, 1996.

13. J. Chen, J.A. Farrell, C. Nett, K. Zhou, " $H_\infty$  identification of multivariable systems by tangential interpolation methods," *IEEE Transactions on Automatic Control*, vol 41, no. 12, pp. 1822-1827, 1996.
14. J.A. Farrell, "Persistence of excitation conditions in passive learning control," *Automatica*, vol 33, no. 4, pp. 699-703, 1997.
15. J. Farrell, M. Djodat, M. Barth, M. Grewel, "Latency compensation for differential GPS," *Navigation: The Institute of Navigation*, vol. 44, no. 1, pp. 99-107, 1997.
16. J. Farrell, "On performance evaluation in on-line approximation for control," *IEEE Transactions on Neural Networks*, vol 9, no. 5, pp. 1001-1007, 1998.
17. J. Farrell, "Stability and approximator convergence in nonparametric nonlinear adaptive control," *IEEE Transactions on Neural Networks*, vol. 9, no. 5, pp. 1008-1020, 1998.
18. A. Wistrom, J. Farrell, "Simulation and system identification of dynamic models for flocculation control," *IAWQ Journal Water Science and Technology*, vol 37, no. 12, pp. 181-192, 1998.
19. N. Sureshbabu, J.A. Farrell, "Wavelet based system identification for nonlinear control applications," *IEEE Trans. Automatic Control*, vol. 44, no. 2, pp. 412-417, 1999.
20. J.Y. Choi, J.A. Farrell, "Nonlinear adaptive control using networks of piecewise linear approximators," *IEEE Transactions on Neural Networks*, vol 11, no. 2, pp. 390-401, 2000.
21. J. Farrell, T. Givargis, "Differential GPS reference station algorithm: Design and analysis," *IEEE Transactions on Control Systems Technology*, vol 8, no. 3, pp. 519-531, 2000.
22. J. Farrell, T. Givargis, M. Barth, "Real-time differential carrier phase GPS-aided INS," *IEEE Transactions on Control Systems Technology*, vol 8, no. 4, pp. 709-721, 2000.
23. W. Li, X.G. Chang, F. Wahl, J. Farrell, "Tracking control of a manipulator under uncertainty by FUZZY P+I D controller," *Fuzzy Sets and Systems, Elsevier Science: North Holland*, vol 122, pp. 125-137, 2001.
24. W. Li, X.G. Chang, J.A. Farrell, F.M. Wahl, "Design of an Enhanced Hybrid Fuzzy P+ID Controller For a Mechanical Manipulator," *IEEE Systems, Man, and Cybernetics - Part B: Cybernetics*, 31, 6, 938-945, 2001.
25. W. Li, J.A. Farrell, R.T. Cardé, "Tracking of Fluid-Advection Odor Plumes: Strategies Inspired by Insect Orientation to Pheromone," *Adaptive Behavior*, 9, 3/4, 143-170, 2001.
26. J.Y. Choi, J.A. Farrell, "Adaptive observer based backstepping control using neural networks," *IEEE Transactions on Neural Networks*, vol 12, no. 5, pp. 1103-1112, 2002.
27. J. Stoev, J.-Y. Choi, J.A. Farrell, "Adaptive control for output feedback nonlinear systems in the presence of modeling errors," *Automatica*, 38, 10, 1761-1767, 2002.
28. J.A. Farrell, J. Murlis, W. Li, R.T. Carde, "Filament-Based Atmospheric Dispersion Model to Achieve Short Time-Scale Structure of Odor Plumes," *Environmental Fluid Mechanics*, vol. 2 2002, pp. 143-169, 2002.
29. Y. Yang, J.A. Farrell, "Magnetometer and Differential Carrier Phase GPS aided INS for Advanced Vehicle Control," *IEEE Trans. Robotics and Automation*, 19, 2, 269-183, 2003.

30. Y. Yang, J.A. Farrell, "Two Antenna GPS aided INS for Attitude Determination," *IEEE Trans. on Control Systems Technology*, 11, 6, 905-918, 2003.
31. J.A. Farrell, S. Pang, W. Li, "Plume Mapping via Hidden Markov Methods," *IEEE Trans. SMC-B*, 33, 6, 850-863, 2003.
32. J.A. Farrell, H.S. Tan, Y. Yang, "Carrier Phase GPS-aided INS based Vehicle Lateral Control," *ASME Journal of Dynamics Systems, Measurement, & Control*, 125, 3, 339-353, 2003.
33. J. A. Farrell, M. Polycarpou, M. Sharma, "Longitudinal Flight Path Control using On-line Function Approximation," *AIAA Journal of Guidance, Control and Dynamics*, 26, 6, 885-897, 2003.
34. J. Nakanishi, J. A. Farrell, S. Schaal, "Composite Adaptive Control with Locally Weighted Statistical Learning," *Neural Networks*, 18, 1, 71-90, 2005.
35. J. A. Farrell, S. Pang, W. Li, "Chemical Plume Tracing via an Autonomous Underwater Vehicle," *IEEE J. of Oceanic Engineering*, 30, 2, 428-442, 2005.
36. J. A. Farrell, M. Sharma, M. Polycarpou, "On-line Approximation Based Fixed-Wing Aircraft Control," March, *AIAA Journal of Guidance, Control and Dynamics*, 28, 6, 1089-1102, 2005.

### c. Symposia/Conference Proceedings

1. A. Michel, J. Farrell, W. Porod, "Qualitative analysis of neural networks," *Int. Symp. Mathematical Theory of Networks and Systems*, Phoenix, Arizona, June 1987, 1-8, 1987.
2. A. Michel, J. Farrell, W. Porod, "Qualitative analysis of neural networks: Local theory," *Proc. 25th Ann. Allerton Conf., University of Illinois*, Urbana, Illinois, September 1987, pp. 989-992, 1987 (Non-Refereed).
3. A. Michel, W. Porod, J. Farrell, "Stability results for neural networks," *IEEE Conf. Neural Inform. Proc. Syst.*, Denver, Colorado, November 1987, pp. 51-55, 1987 (Non-Refereed).
4. J. Farrell, A.N. Michel, "Asymptotic trajectory bounds in digital implementations of linear feedback control systems," *Proc. 22nd Ann. Conf. Inform, Sciences & Systems*, Princeton, New Jersey, March 1988, pp. 1877-1881, 1988 (Non-Refereed).
5. A.N. Michel, J.A. Farrell, W. Porod, "Qualitative analysis of neural networks," *Proc. IEEE Int. Symp. Circuits & Syst.*, Helsinki, Finland, June 1988, pp. 989-992, 1988.
6. J. Farrell, A. Michel, "New estimates of asymptotic trajectory bounds for digital filters: Improved results," *Proc. 26th Annual Allerton Conf. Communication, Control, & Computing*, University of Illinois, Urbana, Illinois, September 1988, pp. 852-861, 1988 (Non-Refereed).
7. R.K. Miller, A.N. Michel, J.A. Farrell, "Quantizer effects on steady-state error specifications of digital feedback control systems," *Proc. 27th IEEE Conf. Decision & Control*, Austin, Texas, December 1988, pp. 1897-1901, 1988.
8. J.A. Farrell, A.N. Michel, "Estimates of asymptotic trajectory bounds in digital implementations of linear feedback control systems," *Proc. 27th IEEE Conf. Decision & Control*, Austin, Texas, December 1988, pp. 1877-1882, 1988.

9. A.N. Michel, J.A. Farrell, H.F. Sun, "Analysis techniques for Hopfield type synchronous discrete time neural networks," *Proc. 1989 Conf. Information Sciences & Systems*, Baltimore, Maryland, March 1989, pp. 597-602, 1989 (Non-Refereed).
10. A.M. Michel, J.A. Farrell, D.L. Gray, W. Porod, "Some results on the modeling, analysis, and design of neural networks," *Proc. IEEE Int. Symp. Circuits & Systems*, Portland, Oregon, May 1989, pp. 482-485, 1989.
11. J.A. Farrell, A.N. Michel, "A synthesis procedure for Hopfield's continuous time content addressable memory," *Proc. IEEE Int. Symp. Circuits & Systems*, Portland, Oregon, May 1989, pp. 2173-2176, 1989.
12. A.N. Michel, J.A. Farrell, "Design techniques of neural networks for associative memories," *Proc. 28th IEEE Conf. Decision & Control*, Tampa, Florida, December 1989, pp. 252-259, 1989.
13. A. N. Michel, J.A. Farrell, H.F. Sun, "Synthesis techniques for discrete time neural network models," *Proc. 28th IEEE Conf. Decision & Control*, Tampa, Florida, December 1989, pp. 773-778, 1989.
14. A.N. Michel, J.A. Farrell, "Digital implementations of linear feedback controllers: Qualitative properties and limitations," *Proc. 28th IEEE Conf. Decision & Control*, Tampa, Florida, December 1989, pp. 2233-2237, 1989.
15. W. Goldenthal, J. Farrell, "Application of neural networks to automatic control," *Proc. AIAA Guidance, Navigation, & Control Conf.*, Portland Oregon, August 1990, pp. 1108-1112, 1990.
16. W.L. Baker, J.A. Farrell, "Connectionist learning systems for control," *Proc. SPIE Int. Soc. of Optical Eng.*, Boston, Massachusetts, November 1990, pp.181-198, 1990 (Non-Refereed).
17. J. Farrell, B. Goldenthal, K. Govindarajan, "Connectionist learning control systems: Submarine depth control," *Proc. 29th Ann. IEEE Conf. Decision & Control*, Honolulu, Hawaii, December 1990, pp. 2362-2367, 1990.
18. J.S. Alexander, L.C. Baird, W.L. Baker, J.A. Farrell, "A design & simulation tool for connectionist learning control systems: Application to autonomous underwater vehicles," *Proc. SCS Summer Computer Simulation Conf.*, Baltimore, Maryland, July 1991, pp. 771-776, 1991 (Non-Refereed).
19. W.L. Baker, J.A. Farrell, "Learning augmented flight control for high performance aircraft," *Proc. AIAA Conf. Guidance, Navigation, & Control*, New Orleans, Louisiana, August 1991, pp. 347-358, 1991.
20. J. Farrell, W. Baker, "Learning augmented control for advanced autonomous underwater vehicles," *Proc. 18th Ann. Symp. & Exhibit Assoc. Unmanned Vehicle Systems*, Washington, DC, August 1991, pp. 462-468, 1991 (Non-Refereed).
21. M.M. Livstone, J.A. Farrell, W.L. Baker, "A computationally efficient algorithm for training recurrent connectionist networks," *Proc. Amer. Controls Conf.*, Chicago, Illinois, June 1992, pp. 555-561, 1992.
22. J. Farrell, B. Appleby, T. Berger, "On the detection and accommodation of unanticipated faults," *Proc. AIAA Conf. Guidance, Navigation, & Control*, Hilton Head, South Carolina, August 1992, pp. 1045-1054, 1992.
23. B. Clauberg, J. Farrell, "Issues in the implementation of an indirect adaptive control system," *Proc. 1st IEEE Conf. Control Applications*, Dayton, Ohio, September 1992, pp. 1068-1075, 1992.
24. R. Mangoubi, B. Appleby, J. Farrell, "Robust estimation in fault detection," *Proc. 31st IEEE Conf. Decision & Control*, Tucson, AZ, December 1992, pp. 2317-2322, 1992.

25. J. Farrell, J. Plump, "Adaptive ballast control," *Proc. 20th Ann. Symp. & Exhibit Assoc. Unmanned Vehicle Systems*, Washington, DC, June 1993, pp. 322-329, 1993 (Non-Refereed).
26. J. Farrell, M. Livstone, "Exact calculation of discrete-time process noise statistics for hybrid continuous/discrete time applications," *Proc. 32nd IEEE Conf. Decision & Control*, San Antonio, Texas, December 1993, pp. 857-858, 1993.
27. M.M. Livstone, M.A. Dahleh, J.A. Farrell, "A framework for robust control based model invalidation," *Proc. 1994 Amer. Control Conf.*, Baltimore, Maryland, June 1994, pp. 3017-3020, 1994.
28. W.D. Hall, J.A. Farrell, "Activity-based mission planning and plan management for autonomous vehicles," *Proc. 1994 IEEE Symp. Autonomous Underwater Vehicle Tech.*, Cambridge, Massachusetts, July 1994, pp. 45-53, 1994 (Non-Refereed).
29. J. Chen, J. Farrell, C.N. Nett, K. Zhou, " $H_\infty$  identification of multivariable systems by tangential interpolation methods," *Proc. 32nd IEEE Conf. Decision & Control*, Lake Buena Vista, Florida, December 1994, pp. 4158-4163, 1994.
30. J.A. Farrell, T. Berger, "On the effects of the training sample density in passive learning control," *Proc. 1995 American Control Conf.*, Portland, Oregon, June 1995, pp. 872-877, 1995.
31. M. M. Livstone, M.A. Dahleh, J.A. Farrell, "A new framework for iterative identification and control," *Proc. 1995 IEEE American Control Conference ACC '95*, Seattle, Washington, June 1995, pp. 3546-3550, 1995.
32. N. Sureshbabu, J.A. Farrell, "Wavelet based system identification for nonlinear control applications," *Proc. 10th IEEE Int. Symp. Intelligent Control*, Monterey, California, August 1995, pp. 236-241, 1995.
33. M. Grewal, J. Farrell, M. Barth, "Application of DGPS/INS to automobile navigation with latency compensation," *1996 IEEE Position Location & Navigation Symp*, Atlanta, Georgia, April 1996, pp. 433-436, 1996 (Non-Refereed).
34. J.A. Farrell, "Persistence of excitation conditions in passive learning control," *Proc. Int. Federation Automatic Control Conf.*, San Francisco, California, June 1996, pp. 313-318, 1996.
35. A. Wistrom, J. Farrell, "Automatic control of flocculation processes," *ASCE Proc. North American Water Environ. Congress '96*, Anaheim, California, June 1996, 997-1002, 1996.
36. J.A. Farrell, "Approximator characteristics and their effect on training misbehavior in passive learning control," *1996 IEEE Int. Symp. Intelligent Control*, Detroit, Michigan, September 1996, pp. 181-187, 1996.
37. J. Farrell, M. Grewal, M. Djodat, M. Barth, "Differential GPS with latency compensation for autonomous navigation," *1996 IEEE Int. Symp. Intelligent Control*, Detroit, Michigan, September 1996, pp. 20-25, 1996.
38. J. Farrell, "Exponential convergence conditions for passive learning control," *Proc. 1997 American Control Conference*, New Mexico, June 1997, pp. 1809-1813, 1997.
39. J. Farrell, "On performance evaluation in on-line approximation based control: methods and pitfalls," *Proc. 1997 IEEE CDC*, New Mexico, June 1997, pp. 1585-1590, 1997.
40. J. Farrell, A. Wistrom, "Flocculation control: System identification - experimental results," *Proc. 7th IAWQ ICAWorkshop*, Brighton, United Kingdom, July 1997, pp. 373-380, 1997.

41. A. Wistrom, J. Farrell, "Simulation of dynamic models for automatic flocculation control," *Proc. 7th IAWQ ICAWorkshop*, Brighton, United Kingdom, July 1997, pp. 381-386, 1997.
42. W. Li, F.M. Wahl, B. Krebs, J.A. Farrell, "Extraction of line and step edges by fuzzy reasoning," *Int. Conf. on Computational Intelligence for Modeling Control, and Automation*, Vienna, Austria, February 1999, pp. 507-512, 1999.
43. X.G. Chang, W. Li, J. A. Zhou, J.A. Farrell, "Dynamic behavior modeling of stoker-fired boilers by recurrent fuzzy-neuro networks," *Int. Conf. on Computational Intelligence for Modeling Control, and Automation*, Vienna, Austria, February 1999, pp. 190-195, 1999.
44. J. Farrell, T. Givargis, "Experimental differential GPS reference station evaluation," *Proceedings of the 1999 American Control Conference*, San Diego, California, June 1999, pp. 3645-3649, 1999.
45. J. Farrell, T. Givargis, M. Barth, "Differential carrier phase GPS-aided INS for automotive applications," *Proceedings of the 1999 American Control Conference*, San Diego, California, June 1999, pp. 3660-3664, 1999.
46. J.Y. Choi, J.A. Farrell, "Adaptive observer for a class of nonlinear systems using neural networks," *Proceedings of the 1999 IEEE International Symposium on Intelligent Control*, Cambridge, Massachusetts, September 1999, pp. 114-119, 1999.
47. J.Y. Choi, J.A. Farrell, "Nonlinear adaptive control using networks of piecewise linear approximators," *38th IEEE Conference on Decision and Control*, Phoenix, Arizona, December 1999, pp. 1671-1676, 1999.
48. Y. Yang, J. Farrell, M. Barth, "High-accuracy, high frequency differential carrier phase GPS aided low-cost INS," *IEEE PLANS*, San Diego, California, March 2000, pp. 148-155, 2000.
49. X. Chang, W. Li, J. Farrell, "A C-means clustering based fuzzy modeling method," *Proceedings of the 2000 IEEE International Conference on Fuzzy Systems*, San Antonio, Texas, May 2000, pp. 937-40, 2000.
50. J. Choi, J. Farrell, "Observer-based backstepping control using on-line approximation," *Proceedings of the 2000 IEEE American Controls Conference*, Chicago, Illinois, June 2000, pp. 3646-3650, 2000.
51. W. Williamson, J. Min, J. Speyer, J. Farrell, "A comparison of state space, range space, and carrier phase differential GPS/INS relative navigation," *Proceedings of the 2000 IEEE American Controls Conference*, Chicago, Illinois, June 2000, pp. 2932-2938, 2000.
52. W. Li, J. Farrell, F.M. Wahl, K.R. Kozlowski, "A nonholonomic mobile robot navigation in uncertain environments based on behavior control," *Proceedings of World Automation Congress*, Maui, Hawaii, June 2000, 7 m.s.p. in CD-ROM (no hard copy), 2000.
53. Y. Yang, J. Farrell, H.S. Tan, "Carrier Phase Differential GPS-aided INS based Vehicle Control: Experimental Results," *2001 ION National Technical Meeting*, Long Beach, CA, January 2001, pp. 679-689, 2001.
54. Y. Yang, J. Farrell, "Magnetometer and Carrier Phase GPS aided INS for Automotive Control," *2001 ION National Technical Meeting*, Long Beach, CA, January 2001, pp. 690-695, 2001.
55. Y. Yang, J. A. Farrell, H.S. Tan, "GPS-aided INS Based Control State Calculation for AHS," *2001 American Control Conference*, Arlington, VA, June 2001, pp. 2321-2326, 2001.
56. S. Pang, J. Farrell, J. Du, M. Barth, "Battery State-of-Charge Estimation," *2001 American Control Conference*, Arlington, VA, June 2001, pp. 1644-1649, 2001.

57. W. Li, X. Chang, J. Farrell, "Stability and performance analysis of an enhanced hybrid fuzzy p+id controller," *2001 American Control Conference*, Arlington, VA, June 2001, pp. 3855-3860, 2001.
58. J. Stoev, J.Y. Choi, J.A. Farrell, "Adaptive neuro control for output feedback nonlinear systems," *2001 American Control Conference*, Arlington, VA, June 2001, pp. 3097-3102, 2001.
59. V.K. Gazi, M. Passino, J. A. Farrell, "Adaptive Control of Discrete Time Nonlinear Systems Using Dynamic Structure Approximators," *2001 American Control Conference*, Arlington, VA, June 2001, pp. 3091-3096, 2001.
60. Y. Yang, J. Farrell, "Fast Ambiguity Resolution for GPS/IMU Attitude Determination," *ION GPS 2001*, Salt Lake City, UT, September 2001, pp. 2990-2997, 2001.
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