

# Jason R. Marden

Assistant Professor

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## Area of Interest

Feedback control and systems theory. Game theoretic methods for coordination of large scale distributed systems. Application to distributed traffic routing, dynamic resource allocation, queueing systems, and sensor networks.

## Education

- 2007            Doctor of Philosophy in Mechanical and Aerospace Engineering  
Dissertation: *Learning in Large-Scale Games and Cooperative Control*.  
*University of California Los Angeles*  
Advisor: Jeff S. Shamma
- 2004            Master of Science in Mechanical Engineering  
Thesis: *Coordination of Multiple Agents Using Neuro-Dynamic Programming*.  
*University of California Los Angeles*
- 2001            Bachelor of Science in Mechanical Engineering (Cum Laude)  
*University of California Los Angeles*

## Academic Appointments

- 2010–present    **Assistant Professor**. Department of Electrical, Computer and Energy Engineering, University of Colorado at Boulder.
- 2007–2009      **Junior Fellow**. Social and Information Sciences Laboratory, California Institute of Technology.
- 2006–2007      **Research Scientist**. Department of Electrical Engineering, University of Hawaii at Manoa.

## Awards and Honors

- 2009            Keynote Speaker, ALADDIN Game Theory Workshop, University of Bristol.
- 2007            Outstanding Graduating PhD Student in Mechanical Engineering, UCLA.
- 2007            Post-Doctoral Fellowship, Caltech. Social and Information Sciences Laboratory.
- 2001            Graduate Fellowship, UCLA. Department of Mechanical and Aerospace Engineering.
- 2001            Raytheon Excellent Achievement Award.

## Funded Research Projects

1. “Distributed learning and information dynamics in networked autonomous systems”, AFOSR/MURI, subcontract through Johns Hopkins, 6/1/10 – 9/30/11, \$75,846.
2. “An Innovative Approach to the Design and Control of Wind Farms”, Center for Research and Education in Wind (CREW), 6/1/11–5/31/12, \$25,000.

## Journal Publications

1. J.R. Marden, H.P. Young, and L.Y. Pao, “Achieving Pareto Optimality Through Distributed Learning,” Discussion Paper, University of Oxford, 2011.
2. N. Li and J.R. Marden, “Decoupling Coupled Constraints Through Utility Design,” *Automatica*, 2011 (under review).
3. J.R. Marden, “State Based Potential Games,” *IEEE Transactions on Automatic Control*, 2011 (under review).
4. J.R. Marden and A. Wierman, “The Limitations of Utility Design for Multiagent Systems,” *IEEE Transactions on Automatic Control*, 2011 (under review).
5. J.R. Marden and M. Effros, “The Price of Selfishness in Network Coding,” *IEEE Transactions on Information Theory*, 2009 (under review).
6. J.R. Marden and A. Wierman, “Distributed Welfare Games,” *Operations Research*, 2009 (under review).
7. J.R. Marden and J.S. Shamma, “Revisiting Log-Linear Learning: Asynchrony, Completeness and a Payoff-based Implementation,” to appear in *Games and Economic Behavior*, 2011.
8. J.R. Marden, G. Arslan and J.S. Shamma, “Connections Between Cooperative Control and Potential Games,” *IEEE Transactions on Systems, Man and Cybernetics. Part B: Cybernetics*, Volume 39, Issue 6, December 2009, pp. 1393-1407.
9. J.R. Marden, H.P. Young, G. Arslan, and J.S. Shamma, “Payoff Based Dynamics for Multi-Player Weakly Acyclic Games,” *SIAM Journal on Control and Optimization*, special issue on “Control and Optimization in Cooperative Networks,” Volume 48, Issue 1, February 2009, pp. 373-396.
10. J.R. Marden, G. Arslan and J.S. Shamma, “Joint Strategy Fictitious Play with Inertia for Potential Games,” *IEEE Transactions on Automatic Control*, Volume 54, Issue 2, February 2009, pp. 208-220.
11. G. Arslan, J.R. Marden and J.S. Shamma, “Autonomous Vehicle-Target Assignment: A Game Theoretical Formulation,” *ASME Journal of Dynamic Systems, Measurement and Control*, Volume 129, Issue 5, September 2007, pp. 584-596.

## Proceedings of Refereed Conferences

1. R. Gopalakrishnan, J.R. Marden, and A. Wierman, “Characterizing Distribution Rules for Cost Sharing Games,” submitted to *NetGCoop*, 2011.
2. L. Na and J.R. Marden, “Designing Games for Distributed Optimization with a Time-Varying Communication Graph,” submitted to *NetGCoop*, 2011.
3. D. Leslie and J.R. Marden, “Equilibrium Selection in Potential Games with Noisy Rewards,” submitted to *NetGCoop*, 2011.

4. J.R. Marden, S. Ruben, and L.Y. Pao, "Surveying Game Theoretic Approaches for Wind Farm Optimization, submitted to *AIAA Aerospace Sciences Meeting*, 2011
5. L. Na and J.R. Marden, "Game Design for Distributed Optimization," to appear in the *50th IEEE Conference on Decision and Control*, 2011.
6. J.R. Marden and J.S. Shamma, "Revisiting Log-Linear Learning: Asynchrony, Completeness and a Payoff-based Implementation," Allerton, 2010.
7. J.R. Marden and T. Roughgarden, "Generalized Efficiency Bounds in Distributed Resource Allocation," *Proceedings of the 49th IEEE Conference on Decision and Control*, 2010.
8. N. Li and J.R. Marden, "Designing Games to Handle Coupled Constraints," *Proceedings of the 49th IEEE Conference on Decision and Control*, 2010.
9. R. Gopalakrishnan, J.R. Marden, and A. Wierman, "An architectural view of game theoretic control," *Proceedings of ACM Hotmetrics*, 2010.
10. J.R. Marden and A. Wierman, "Overcoming Limitations of Game-Theoretic Distributed Control," *Proceedings of the 48th IEEE Conference on Decision and Control*, 2009.
11. N. Li, J.R. Marden, and J.S. Shamma, "Learning Approaches to the Witsenhouse Counterexample from a View of Potential Games," *Proceedings of the 48th IEEE Conference on Decision and Control*, 2009.
12. J.R. Marden and M. Effros, "The Price of Selfishness in Network Coding," *5th Workshop on Network Coding Theory and Applications*, 2009.
13. J.R. Marden and M. Effros, "A Game Theoretic Approach to Network Coding," *Information Theory Workshop on Networking and Information Theory*, June, 2009.
14. H. Chen, J.R. Marden, and A. Wierman, "On the Impact of Heterogeneity and Back-end Scheduling in Load Balancing Designs," *Proceedings of the IEEE Conference on Computer Communications (INFOCOM)*, 2008. (acceptance rate 19%)
15. J.R. Marden and A. Wierman, "Distributed Welfare Games," *Proceedings of the 47th IEEE Conference on Decision and Control*, 2008.
16. J.R. Marden, H.P. Young, G. Arslan, and J.S. Shamma, "Payoff Based Dynamics for Multi-Player Weakly Acyclic Games," *Proceedings of the 46th IEEE Conference on Decision and Control*, 2007.
17. J.R. Marden, G. Arslan and J.S. Shamma, "Connections Between Cooperative Control and Potential Games Illustrated on the Consensus Problem," *Proceedings of the European Control Conference*, 2007.
18. J.R. Marden, G. Arslan and J.S. Shamma, "Regret Based Dynamics: Convergence in Weakly Acyclic Games," *Proceedings of the 2007 International Conference on Autonomous Agents and Multiagent Systems*, 2007. (acceptance rate for full papers < 25%)
19. J.R. Marden, G. Arslan and J.S. Shamma, "Joint Strategy Fictitious Play with Inertia for Potential Games," *Proceedings of the 44th IEEE Conference on Decision and Control*, 2005.

## Lectures and Workshop Presentations

- 07/2011 “Achieving Pareto Efficiency Through Distributed Learning,” *21st International Conference on Game Theory*, Stony Brook University.
- 06/2011 “Utility Design for Distributed Engineering Systems,” Department of Economics, University of Oxford, UK
- 12/2010 “Generalized Efficiency Bounds in Distributed Resource Allocation,” 2010 SISL/Yahoo! Research Microeconomics Workshop, Huntington Beach, CA.
- 3/2010 “Overcoming the Limitations of Game Theoretic Distributed Control,” LCCC Workshop on Distributed Decisions via Games and Price Mechanisms, Lund University, Sweden.
- 11/2009 “Overcoming the Limitations of Game Theoretic Distributed Control,” Cymer Center for Control Systems and Dynamics, UCSD.
- 11/2009 “Overcoming the Limitations of Game Theoretic Distributed Control,” Department of Electrical Engineering, USC.
- 11/2009 “Overcoming the Limitations of Game Theoretic Distributed Control,” Department of Computer Science, Stanford.
- 11/2009 “Overcoming the Limitations of Game Theoretic Distributed Control,” Center for Control Dynamical Systems and Computation, UCSB.
- 10/2009 “Overcoming the Limitations of Game Theoretic Distributed Control,” Center for Systems, Dynamics and Control, UCLA.
- 10/2009 “Distributed Welfare Games,” *INFORMS*, San Diego, CA.
- 09/2009 “Overcoming the Limitations of Game Theoretic Distributed Control,” keynote speaker at the *ALADDIN Game Theory Workshop*, University of Bristol.
- 09/2009 “The Art of Utility Design,” *From Game Theory to Game Engineering Workshop*, University of Oxford.
- 07/2009 “Distributed Welfare Games,” *19th International Conference on Game Theory*, Stony Brook University.
- 04/2009 “Noncooperative Cooperation,” Department of Mechanical Engineering, National Taiwan University.
- 04/2009 “Noncooperative Cooperation,” Department of Electrical and Computer Engineering, University of Colorado at Boulder.
- 03/2009 “Noncooperative Cooperation,” Department of Computer Science and Economics, Caltech.
- 03/2009 “The Price of Selfishness in Network Coding,” 2009 SISL/Yahoo! Research Microeconomics Workshop, Huntington Beach, CA.
- 02/2009 “A Game Theoretic Approach to Network Coding,” Information Theory and Applications Workshop, UCSD.
- 01/2009 “Noncooperative Cooperation,” Decision and Control Laboratory, Georgia Tech.
- 10/2008 “Revisiting Log-Linear Learning: Asynchrony, Completeness and a Payoff-based Implementation,” Workshop on Frontiers in Game Theory and Networked Control Systems, MIT.
- 10/2008 “A Game Theoretic Approach to Network Coding: The Price of Selfish Coding,” Caltech.
- 09/2008 “Non-cooperative Cooperation,” Department of Computer Science, Stanford.
- 09/2008 “Revisiting Log-Linear Learning: Asynchrony, Completeness and a Payoff-based Implementation,” Department of Economics, University of Wisconsin–Madison.
- 07/2008 “Revisiting Log-Linear Learning: Asynchrony, Completeness and a Payoff-based Implementation,” GAMES 2008 – Third World Congress of the Game Theory Society, Northwestern.

- 06/2008 “Non-cooperative Cooperation,” Center for Control, Dynamical Systems and Computation, University of California – Santa Barbara.
- 01/2008 “A Game Theoretic Formulation of the Sensor Allocation Problem,” *Information Science and Technology Seminar*, Caltech.
- 11/2007 “A Non-Cooperative Approach to Cooperative Control,” *2007 SISL/Yahoo! Theory Workshop*, Huntington Beach, CA.
- 09/2007 “A Game Theoretic Approach to Cooperative Control,” Social and Information Sciences Laboratory Seminar Series, Caltech.
- 06/2007 “Payoff Based Dynamics for Multi-Player Weakly Acyclic Games,” *18th International Conference on Game Theory*, Stony Brook University.
- 05/2007 “Learning in Large-Scale Games and Cooperative Control with Applications to Distributed Routing,” Department of Electrical Engineering, UCLA.
- 02/2007 “A Game Theoretic Formulation of the Dynamic Sensor Allocation Problem,” *7th International Conference on Cooperative Control and Optimization*, Gainesville, Florida.
- 01/2007 “Connections Between Cooperative Control Problems and Potential Games,” Center for Neuromorphic Systems Engineering, Caltech.
- 06/2006 “Joint Strategy Fictitious Play with Inertia for Potential Games,” *17th International Conference on Game Theory*, Stony Brook University.
- 05/2005 “Joint Strategy Fictitious Play with Inertia for Potential Games,” *11th Southern California Nonlinear Control Workshop*, UCSD.
- 05/2005 “ $\delta$ -Passive Joint Strategy Fictitious Play for Potential Games,” *4th Annual UCLA Systems & Controls Symposium 2005*, UCLA.

## Industrial Work Experience

- 2004–present **Engineering Consultant.** InfoLenz Corporation.  
*Project:* Optimization of Manufacturing Plan for Jet Engine Maintenance. Optimized part supply plan for a five year overhaul plan of a fleet of over 500 jet engines by minimizing the number of stocked parts while adhering to a maximum probability of missing a part using neuro-dynamic programming and reinforcement learning. The designed supply plan is currently in the process of being implemented.  
*Project:* Optimization of JEM-EF Maintenance by Neuro-Dynamic Programming. Optimized maintenance policy for the exposure facility of a space station while adhering to system availability requirements and monetary constraints using dynamic and neuro-dynamic programming.
- 2005–2007 **Cofounder and Instructor.** SoCal Test Prep. Los Angeles, CA.  
 Cofounded a test preparation company to help students prepare for graduate school entrance exams. Focused on developing students analytical and problem solving skills. SoCal Test Prep instructed approximately 20 students with a high success rate.
- 1998–2007 **Controls Analyst.** Raytheon Systems Corporation, Space and Airborne Systems. El Segundo, CA.  
 Developed and implemented a procedure for dynamically balancing a beam steering mirror. Designed and developed an optical analysis program, HexMat, to aid in visualization and sensitivity calculation of any optical system. Received Raytheon Excellent Achievement Award for development of HexMat.

## Teaching Experience

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| Fall 2011   | <i>Instructor.</i> Dynamic Programming, UCB.  |
| Spring 2011 | <i>Instructor.</i> Game Theory and Multiagent Systems, UCB.   |
| Spring 2010 | <i>Instructor.</i> Game Theory and Multiagent Systems, UCB.   |
| Winter 2008 | <i>Co-Instructor.</i> Topics in Algorithmic Game Theory, Caltech.   |
| Fall 2007   | <i>Co-Instructor.</i> Queueing Network Games, Caltech.  |
| Winter 2006 | <i>Teaching assistant.</i> MAE174 Probability and Statistics, UCLA.<br><b>Average Reviews: 8.00 / 9</b> (available upon request)                    |
| Winter 2005 | <i>Teaching assistant.</i> MAE174 Probability and Statistics, UCLA.<br><b>Average Reviews: 8.14 / 9</b> (available upon request)                    |
| Fall 2002   | <i>Teaching assistant.</i> MAE171A Introduction to Feedback and Control Systems, UCLA.<br><b>Average Reviews: 8.75 / 9</b> (available upon request) |

## Advising Experience

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| 2011–present | <i>Postdoctoral advisor</i> for Shalom Ruben, University of Colorado at Boulder, on wind farm optimization.                              |
| 2011–present | <i>Graduate advisor</i> for Yilan Chen, University of Colorado at Boulder, on game theory and cooperative control.                       |
| 2010–present | <i>Graduate advisor</i> for Matthew Kirchner, University of Colorado at Boulder, on efficiency bounds for distributed sensor allocation. |
| 2009–present | <i>Graduate mentor</i> for Ragavendran Gopalakrishnan, Caltech, on utility design for distributed engineering systems.                   |
| 2008–2010    | <i>Graduate mentor</i> for Kenneth McKell, University of Hawaii at Manoa, on distributed resource allocation.                            |
| 2007–present | <i>Graduate mentor</i> for Na Li, Caltech, on game theoretic control of sensor networks.   |
| 2008         | <i>Undergraduate mentor</i> for Sherwin Doroudi, Caltech, 2008 SURF. A game theoretic approach to the sensor coverage problem.           |
| 2007         | <i>Undergraduate mentor</i> for Na Li, UCLA and Zhejiang University, on a game theoretic approach to the team decision problem.          |
| 2006         | <i>Undergraduate mentor</i> for Pedram Vaghefinazari, UCLA, on interactive webpage development for distributed traffic control.          |
| 2004         | <i>Undergraduate mentor</i> for Matthew W. Messina, UCLA, on development of interactive simulations for undergraduate controls class.    |

## Professional Services

*Referee for Journals and Conferences:* Conference on Decision and Control (CDC), American Control Conference (ACC), Gamesnet, AAMAS, Electronic Commerce (EC), Sigmetrics, Infocom, Machine Learning Journal, IEEE Transactions on Control Systems Technology, IEEE Transactions on Automatic Control, Automatica, SIAM Journal on Control and Optimization, ASME Journal of Dynamic Systems, Measurement and Control, International Journal on Game Theory, Games and Economic Behavior, Operations Research, IEEE Journal on Scheduling, IEEE Letters, Wind Energy