Makan Fardad

Electrical Eng. & Computer Sci.　　　　　　　　　　　　　　　　Tel: (805) 280–1232
3-189 SciTech, Syracuse Univ.　　　　　　　　　　　　　　　Email: makan@syr.edu
Syracuse, NY 13244　　　　　　　　　　　　　http://ecs.syr.edu/faculty/fardad

Academic Appointments

Assistant Professor (Tenure-Track)　　　Syracuse University, Aug 2012 – present
Department of Electrical Engineering & Computer Science.

Assistant Professor (Non Tenure-Track)　　Syracuse University, Aug 2008 – Aug 2012
Department of Electrical Engineering & Computer Science.

Postdoctoral Associate　　　　　University of Minnesota, Sep 2006 – May 2008
Department of Electrical & Computer Engineering.

Education

PhD in Mechanical Engineering　　　University of California, Santa Barbara, 2006
Thesis: *Analysis of Distributed Spatially Periodic Systems.*
Advisor: Bassam Bamieh.

MSc in Electrical Engineering　　　Iran University of Science and Technology, 2000
Thesis: *Optimal Discretization of Continuous-Time Systems.*
Advisors: A.H. Davaie-Markazi, J. Poshtan.

BSc in Electrical Engineering　　　　Sharif University of Technology, Iran, 1998

Awards and Recognitions

National Science Foundation Award, Sep 2016 – Aug 2019.

National Science Foundation EAGER Award, Aug 2015.

Dean's Award for Excellence in Engineering Education, Apr 2015.

National Science Foundation Award, Oct 2013 – Sep 2016.

National Science Foundation Award, Aug 2009 – Jul 2012.

Best Session Presentation Award, American Control Conference, 2005.

President's Work-Study Award, University of California, Santa Barbara, 2003 – 2006.

Ranked 1st in Electrical Engineering Graduate Program (in class of approx. 90 students), Iran University of Science and Technology, Spring 2000.

Ranked Top 5% of National Graduate Program Entrance Exam, Iran, 1998.

Ranked Top 1% of National Undergraduate Entrance Exam, Iran, 1994.

Primary Research Areas

Design and optimization of complex collaborative networks.

Synchronization and consensus in multi-agent networks.

Sparsity-promoting optimal control of interconnected systems.

Computational tools for network optimization.

Input-output analysis of partial differential equations.

Grants

Syracuse University Award (jointly with Amit Sanyal and Senem Velipasalar) "Toward Full Onboard Autonomy for Unmanned Vehicles in GPS-Denied Environments," 1 Nov 2016 – 1 April 2017, \$39,823.00.

National Science Foundation Award (jointly with Yingbin Liang and Pramod K. Varshney) "Management of Mobile Phone Sensing via Sparse Learning," 1 Sep 2016 – 31 Aug 2019, Award Number ECCS-1609916, \$400,000.00.

National Science Foundation EAGER Award "Identification and Design of Optimal Communication Topologies in Collaborative Networks," 15 Aug 2015 – 31 July 2016, Award Number ECCS-1545270, \$100,000.00.

National Science Foundation Award "A Unified System Theoretic Framework for Cyber Attack-Resilient Power Grid," 01 Oct 2013 – 30 Sept 2016, Award Number ECCS-1329885, \$122,000.00.

National Science Foundation Award "Algorithms for Design of Structured Distributed Controllers with Application to Large-Scale Vehicular Formations," 15 Aug 2009 – 31 July 2012, Award Number CMMI-0927509, \$125,000.00.

Teaching

ELE 603: *Functional Methods of Eng. Analysis* (Graduate).	Spring 2013 – 2017
ELE 612: *Modern Control Systems* (Graduate).	Fall 2008, 2011, 2013, 2014, 2016, 2017
ELE 712: *Optimal Control* (Graduate).	Fall 2012
ELE 312: *Control Systems* (Undergraduate).	Spring 2009, 2011, 2012
ELE 351: *System and Signal Analysis* (Undergraduate).	Fall 2009, 2010

Service

Faculty Council member for College of Engineering & Computer Science.	Fall 2016 – present
Conference-Editorial-Board Associate Editor for IEEE Control Systems Society.	Summer 2015 – present
Panelist for National Science Foundation.	2015, 2016
Faculty search committee member in Mechanical & Aerospace Engineering.	Spring 2015
Electrical Engineering Program Committee Chair.	Summer 2014 – Summer 2016
Committee member for faculty search in Applied Mathematics.	Fall 2014, Fall 2015
Committee member for curriculum development in Business Analytics graduate program.	Fall 2014 – present

Publications (Available in pdf format at http://ecs.syr.edu/faculty/fardad)

Journals – Published/To Appear

[1] M. Fardad, "On optimality of sparse long-range links in circulant consensus networks," *IEEE Transactions on Automatic Control*, vol. 62, pp. 4050–4057, Aug. 2017.

[2] S. Liu, S. Kar, M. Fardad, and P. K. Varshney, "Optimized sensor collaboration for estimation of temporally correlated parameters," *IEEE Transactions on Signal Processing*, vol. 64, pp. 6613–6626, Dec. 2016.

[3] S. Liu, S. P. Chepuri, M. Fardad, E. Masazade, G. Leus, and P. K. Varshney, "Sensor selection for estimation with correlated measurement noise," *IEEE Transactions on Signal Processing*, vol. 64, pp. 3509–3522, July 2016.

[4] S. Liu, S. Kar, M. Fardad, and P. K. Varshney, "Joint design of optimal sensor selection and collaboration strategies for distributed estimation," *IEEE Communications Society MMTC Communications - Frontiers*, vol. 11, pp. 4–10, May 2016.

[5] M. N. Mojdehi, M. Fardad, and P. Ghosh, "Technical and economical evaluation of reactive power service from aggregated EVs," *Electric Power Systems Research*, vol. 133, pp. 132–141, April 2016.

[6] S. Liu, S. Kar, M. Fardad, and P. K. Varshney, "Sparsity-aware sensor collaboration for linear coherent estimation," *IEEE Transactions on Signal Processing*, vol. 63, pp. 2582–2596, May 2015.

[7] M. Fardad, F. Lin, and M. R. Jovanović, "Design of optimal sparse interconnection graphs for synchronization of oscillator networks," *IEEE Transactions on Automatic Control*, vol. 59, pp. 2457–2462, 2014.

[8] S. Liu, A. Vempaty, M. Fardad, E. Masazade, and P. K. Varshney, "Energy-aware sensor selection in field reconstruction," *IEEE Signal Processing Letters*, vol. 21, pp. 1476–1480, Dec. 2014.

[9] F. Lin, M. Fardad, and M. R. Jovanović, "Algorithms for leader selection in stochastically forced consensus networks," *IEEE Transactions on Automatic Control*, vol. 59, pp. 1789–1802, 2014.

[10] S. Liu, M. Fardad, E. Masazade, and P. K. Varshney, "Optimal periodic sensor scheduling in large-scale dynamical networks," *IEEE Transactions on Signal Processing*, vol. 62, pp. 3055–3068, 2014.

[11] F. Lin, M. Fardad, and M. R. Jovanović, "Design of optimal sparse feedback gains via the alternating direction method of multipliers," *IEEE Transactions on Automatic Control*, vol. 58, pp. 2426–2431, 2013.

[12] E. Masazade, M. Fardad, and P. K. Varshney, "Sparsity-promoting extended Kalman filtering for target tracking in wireless sensor networks," *IEEE Signal Processing Letters*, vol. 19, pp. 845–848, 2012.

[13] F. Lin, M. Fardad, and M. R. Jovanović, "Optimal control of vehicular formations with nearest neighbor interactions," *IEEE Transactions on Automatic Control*, vol. 57, pp. 2203–2218, 2012.

[14] F. Lin, M. Fardad, and M. R. Jovanović, "Augmented Lagrangian approach to design of structured optimal state feedback gains," *IEEE Transactions on Automatic Control*, vol. 56, pp. 2923–2929, 2011.

[15] M. Fardad and M. R. Jovanović, "Design of optimal controllers for spatially invariant systems with finite communication speed," *Automatica*, vol. 47, pp. 880–889, 2011.

[16] R. Rajaram, U. Vaidya, M. Fardad, and B. Ganapathysubramanian, "Stability in the almost everywhere sense: A linear transfer operator approach," *Journal of Mathematical Analysis and Applications*, vol. 368, pp. 144–156, 2010.

[17] M. Fardad and B. Bamieh, "A necessary and sufficient frequency domain criterion for the passivity of SISO sampled-data systems," *IEEE Transactions on Automatic Control*, vol. 54, no. 3, pp. 611–614, 2009.

[18] M. Fardad and B. Bamieh, "Perturbation methods in stability and norm analysis of spatially periodic systems," *SIAM Journal on Control and Optimization*, vol. 47, no. 2, pp. 997–1021, 2008.

[19] M. Fardad, M. R. Jovanović, and B. Bamieh, "Frequency analysis and norms of distributed spatially periodic systems," *IEEE Transactions on Automatic Control*, vol. 53, no. 10, pp. 2266–2279, 2008.

[20] M. Fardad and B. Bamieh, "An extension of the argument principle and Nyquist criterion to a class of systems with unbounded generators," *IEEE Transactions on Automatic Control*, vol. 53, no. 1, pp. 379–384, 2008.

[21] M. R. Jovanović and M. Fardad, "H^2 norm of linear time-periodic systems: A perturbation analysis," *Automatica*, vol. 44, pp. 2090–2098, 2008.

Conferences – Refereed Proceedings

[1] G. Kearney and M. Fardad, "On a linear programming approach to the optimal design of cascading failures," to appear in *Proceedings of the 56th IEEE Conference on Decision and Control*, 2017.

[2] G. Kearney and M. Fardad, "On a framework for analysis and design of cascades on Boolean networks," in *Proceedings of the 55th IEEE Conference on Decision and Control*, pp. 997–1002, Dec. 2016.

[3] S. Liu, Y. Wang, M. Fardad, and P. Varshney, "Optimal energy allocation and storage control for distributed estimation with sensor collaboration," in *Proceedings of the 50th Annual Conference on Information Sciences and Systems*, pp. 42–47, March 2016.

[4] M. Fardad, "On consensus-based community detection," in *Proceedings of the 54th IEEE Conference on Decision and Control*, pp. 1577–1582, Dec. 2015.

[5] S. Liu, S. Kar, M. Fardad, and P. K. Varshney, "On optimal sensor collaboration for distributed estimation with individual power constraints," in *Proceedings of the 49th Asilomar Conference on Signals, Systems and Computers*, pp. 571–575, Nov. 2015.

[6] M. Fardad, "On the optimality of sparse long-range links in circulant consensus networks," in *Proceedings of the 2015 American Control Conference*, pp. 2075–2080, July 2015.

[7] S. Liu, F. Chen, A. Vempaty, M. Fardad, L. Shen, and P. K. Varshney, "Sparsity-promoting sensor management for estimation: An energy balance point of view," in *Proceedings of the 18th International Conference on Information Fusion*, pp. 231–238, July 2015.

[8] M. N. Mojdehi, P. Ghosh, and M. Fardad, "Energy and cost minimization of bidirectional frequency regulation service by EV," in *Proceedings of the 2015 IEEE Power and Energy Society General Meeting*, pp. 1–5, July 2015.

[9] S. Liu, E. Masazade, M. Fardad, and P. K. Varshney, "Sensor selection with correlated measurements for target tracking in wireless sensor networks," in *Proceedings of the 2015 IEEE International Conference on Acoustics, Speech and Signal Processing*, pp. 4030–4034, April 2015.

[10] M. Fardad, X. Zhang, F. Lin, and M. R. Jovanović, "On the properties of optimal weak links in social networks," in *Proceedings of the 53rd IEEE Conference on Decision and Control*, pp. 2124–2129, Dec. 2014. **(Invited paper)**.

[11] M. Fardad, A. Diwadkar, and U. Vaidya, "On optimal link removals for controllability degradation in dynamical networks," in *Proceedings of the 53rd IEEE Conference on Decision and Control*, pp. 499–504, Dec. 2014. **(Invited paper)**.

[12] S. Pushpak, A. Diwadkar, M. Fardad, and U. Vaidya, "Vulnerability analysis of large-scale dynamical networks to coordinated attacks," in *Proceedings of the 2014 Australian Control Conference*, pp. 89–94, Nov. 2014.

[13] S. Liu, E. Masazade, M. Fardad, and P. K. Varshney, "Sparsity-aware field estimation via ordinary Kriging," in *Proceedings of the 2014 IEEE International Conference on Acoustics, Speech and Signal Processing*, pp. 3948–3952, 2014.

[14] S. Liu, M. Fardad, S. Kar, and P. K. Varshney, "On optimal sensor collaboration topologies for linear coherent estimation," in *Proceedings of the 2014 IEEE International Symposium on Information Theory*, pp. 2624–2628, 2014.

[15] M. Fardad and M. R. Jovanović, "On the design of optimal structured and sparse feedback gains via sequential convex programming," in *Proceedings of the 2014 American Control Conference*, pp. 2426–2431, 2014.

[16] M. Fardad, F. Lin, and M. R. Jovanović, "On optimal link creation for facilitation of consensus in social networks," in *Proceedings of the 2014 American Control Conference*, pp. 3790–3795, 2014.

[17] S. Liu, M. Fardad, E. Masazade, and P. K. Varshney, "On optimal periodic sensor scheduling for field estimation in wireless sensor networks," in *Proceedings of the 2013 IEEE Global Conference on Signal and Information Processing*, pp. 137–140, 2013. **(Invited paper)**.

[18] F. Lin, M. Fardad, and M. R. Jovanović, "Leader selection in consensus networks: A convex relaxation approach," in *51st Annual Allerton Conference on Communication, Control, and Computing*, 2013. **(Invited paper)**.

[19] U. Vaidya and M. Fardad, "On optimal sensor placement for mitigation of vulnerabilities to cyber attacks in large-scale networks," in *Proceedings of the 2013 European Control Conference*, pp. 3548–3553, 2013.

[20] M. Fardad, F. Lin, X. Zhang, and M. R. Jovanović, "On new characterizations of social influence in social networks," in *Proceedings of the 2013 American Control Conference*, pp. 4784–4789, 2013.

[21] M. Fardad, X. Zhang, F. Lin, and M. R. Jovanović, "On the optimal dissemination of information in social networks," in *Proceedings of the 51st IEEE Conference on Decision and Control*, pp. 2539–2544, 2012.

[22] F. Lin, M. Fardad, and M. R. Jovanović, "Performance of leader-follower networks in directed trees and lattices," in *Proceedings of the 51st IEEE Conference on Decision and Control*, pp. 734–739, 2012.

[23] F. Lin, M. Fardad, and M. R. Jovanović, "Identification of sparse communication graphs in consensus networks," in *Proceedings of the 50th Annual Allerton Conference on Communication, Control, and Computing*, pp. 85–89, 2012. **(Invited paper)**.

[24] N. Dhingra, F. Lin, M. Fardad, and M. R. Jovanović, "On identifying sparse representations of consensus networks," in *Preprints of the 3rd IFAC Workshop on Distributed Estimation and Control in Networked Systems*, pp. 305–310, 2012.

[25] M. Fardad, F. Lin, and M. R. Jovanović, "On the optimal synchronization of oscillator networks via sparse interconnection graphs," in *Proceedings of the 2012 American Control Conference*, pp. 4777–4782, 2012.

[26] F. Lin, M. Fardad, and M. R. Jovanović, "Sparse feedback synthesis via the alternating direction method of multipliers," in *Proceedings of the 2012 American Control Conference*, pp. 4765–4770, 2012.

[27] M. Fardad, F. Lin, and M. R. Jovanović, "Algorithms for leader selection in large dynamical networks: Noise-free leaders," in *Proceedings of the 50th IEEE Conference on Decision and Control*, pp. 7188–7193, 2011.

[28] F. Lin, M. Fardad, and M. R. Jovanović, "Algorithms for leader selection in large dynamical networks: Noise-corrupted leaders," in *Proceedings of the 50th IEEE Conference on Decision and Control*, pp. 2932–2937, 2011.

[29] M. Fardad, F. Lin, and M. R. Jovanović, "Sparsity-promoting optimal control for a class of distributed systems," in *Proceedings of the 2011 American Control Conference*, pp. 2050–2055, 2011.

[30] M. Fardad, F. Lin, and M. R. Jovanović, "On the dual decomposition of linear quadratic optimal control problems for vehicular formations," in *Proceedings of the 49th IEEE Conference on Decision and Control*, pp. 6287–6292, 2010.

[31] F. Lin, M. Fardad, and M. R. Jovanović, "On the optimal localized feedback design for multi-vehicle systems," in *Proceedings of the 49th IEEE Conference on Decision and Control*, pp. 5744–5749, 2010.

[32] F. Lin, M. Fardad, and M. R. Jovanović, "On the optimal localized feedback design for vehicular platoons," in *Proceedings of the 2010 American Control Conference*, pp. 4622–4627, 2010.

[33] M. Fardad, F. Lin, and M. R. Jovanović, "On the optimal design of structured feedback gains for interconnected systems," in *Proceedings of the 48th IEEE Conference on Decision and Control*, pp. 978–983, 2009.

[34] F. Lin, M. Fardad, and M. R. Jovanović, "Synthesis of H_2 optimal static structured controllers: Primal and dual formulations," in *Proceedings of the 47th Annual Allerton Conference on Communication, Control, and Computing*, 2009. **(Invited paper)**.

[35] H. Higuchi, M. Fardad, M. N. Glauser, R. Bigger, Z. Berger, and A. J. Orbaker, "Disk wake: From open-loop to closed-loop control," in *Proceedings of the 6th International Conference on Flow Dynamics*, pp. 124–125, 2009. **(Invited paper)**.

[36] M. Fardad, "The operator algebra of almost Toeplitz matrices and the optimal control of large-scale systems," in *Proceedings of the 2009 American Control Conference*, pp. 854–859, 2009. **(Invited paper)**.

[37] M. Fardad, M. R. Jovanović, and M. V. Salapaka, "Damping mechanisms in dynamic mode atomic force microscopy applications," in *Proceedings of the 2009 American Control Conference*, pp. 2272–2277, 2009.

[38] M. Fardad and M. R. Jovanović, "On the state-space design of optimal controllers for distributed systems with finite communication speed," in *Proceedings of the 47th IEEE Conference on Decision and Control*, pp. 5488–5493, 2008.

[39] R. Moarref, M. Fardad, and M. R. Jovanović, "Perturbation analysis of eigenvalues of a class of self-adjoint operators," in *Proceedings of the 2008 American Control Conference*, pp. 955–960, 2008. **(Invited paper)**.

[40] R. Rajaram, U. Vaidya, and M. Fardad, "Connection between almost everywhere stability of an ODE and the advection PDE," in *Proceedings of the 46th IEEE Conference on Decision and Control*, pp. 5880–5885, 2007.

[41] M. Fardad and B. Bamieh, "On stability and the spectrum determined growth condition for spatially periodic systems," in *Proceedings of the 45th IEEE Conference on Decision and Control*, pp. 3956–3961, 2006.

[42] M. Fardad and B. Bamieh, "The Nyquist stability criterion for a class of spatially periodic systems," in *Proceedings of the 44th IEEE Conference on Decision and Control*, pp. 5275–5280, 2005.

[43] M. Fardad and B. Bamieh, "A perturbation approach to the H^2 analysis of spatially periodic systems," in *Proceedings of the 2005 American Control Conference*, pp. 4838–4843, 2005.

[44] M. Fardad and B. Bamieh, "A perturbation analysis of parametric resonance and periodic control in spatially distributed systems," in *Proceedings of the 43rd IEEE Conference on Decision and Control*, pp. 3786–3791, 2004.

[45] M. Fardad and B. Bamieh, "A frequency domain analysis and synthesis of the passivity of sampled-data systems," in *Proceedings of the 43rd IEEE Conference on Decision and Control*, pp. 2358–2363, 2004.

[46] B. Bamieh, I. Mezic, and M. Fardad, "A framework for destabilization of dynamical systems and mixing enhancement," in *Proceedings of the 40th IEEE Conference on Decision and Control*, pp. 4980–4983, 2001.

[47] A. H. D. Markazi and M. Fardad, "A new L^∞-induced norm evaluation of classical techniques for discrete time approximation of continuous time functions," *IUST International Journal of Engineering*, vol. 12, no. 2, pp. 135–149, 2001.

[48] A. H. D. Markazi and M. Fardad, "An operator theoretic approach to the optimal discretization of continuous time systems," in *2nd International Conference on Applied Mathematics*, 2000.

Selected/Recent Presentations

[1] "Design of sparse communication topologies in collaborative networks," *Department of Mechanical and Aerospace Engineering, Syracuse University*, April 2017.

[2] "Consensus-based community detection in dynamical networks," *School of Electrical Engineering and Computer Science, Penn State University*, March 2016.

[3] "Consensus-based community detection in dynamical networks," *Applied Math Seminar, Department of Mathematics, Syracuse University*, March 2016.

[4] "On consensus-based community detection," *54th IEEE Conference on Decision and Control*, Osaka, Japan, December 2015.

[5] "Consensus-based community detection in dynamical networks," *Institute for Mathematics and its Applications (IMA), University of Minnesota*, September 2015.

[6] "On the optimality of sparse long-range links in circulant consensus networks," *2015 American Control Conference*, Chicago, July 2015.

[7] "Identification and design of optimal sparse architectures in large-scale networks," *Department of Mathematics and Statistics, Queen's University*, Kingston, Canada, March 2015.

[8] "On the properties of optimal weak links in social networks," *53rd IEEE Conference on Decision and Control*, Los Angeles, December 2014.

[9] "On optimal link removals for controllability degradation in dynamical networks," *53rd IEEE Conference on Decision and Control*, Los Angeles, December 2014.

[10] "A unified system theoretic framework for cyber attack-resilient power grid," *2014 NSF Cyber-Physical Systems Principal Investigators' Meeting*, Arlington, November 2014.

[11] "On the design of optimal structured and sparse feedback gains using semidefinite programming," *2014 American Control Conference*, Portland, June 2014.

[12] "On optimal link creation for facilitation of consensus in social networks," *2014 American Control Conference*, Portland, June 2014.

[13] "On optimal sensor placement for mitigation of vulnerabilities to cyber attacks in large-scale networks," *2013 European Control Conference*, Zurich, Switzerland, July 2013.

Professional Activities

Referee for journals: *AIAA Journal, Automatica, IEEE Control Systems Magazine, IEEE Transactions on Automatic Control, IEEE Transactions on Control of Network Systems, IEEE Transactions on Control Systems Technology, IEEE Transactions on Robotics, Journal of Dynamic Systems, Measurement, and Control, Journal of Vibration and Control, SIAM Journal on Control and Optimization, Systems & Control Letters.*

Referee for conferences: *American Control Conference, European Control Conference, IEEE Conference on Decision and Control, SIAM Conference on Control and Its Applications.*

Additional Information

Citizen of the United States.