

ISLAM I. HUSSEIN

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Personal

Born: December 28, 1977 in Cairo, Egypt

Employment

Assistant Professor, 7/2006-present

Worcester Polytechnic Institute, Worcester, MA

Postdoctoral Research Associate, 8/2005-6/2006

Coordinated Science Laboratory, University of Illinois, Urbana-Champaign, IL

Post-Doctoral Research Assistant, 5/2005-8/2005

Department of Mathematics, University of Michigan, Ann Arbor, MI

Graduate Student Research Assistant, 9/2000-4/2005

Department of Aerospace Engineering, University of Michigan, Ann Arbor, MI

Education

PhD in Aerospace Engineering, University of Michigan, Ann Arbor, February, 2005

Dissertation: Motion Planning for Multi-Spacecraft Interferometric Imaging Systems

Dissertation Advisors: Professors A. M. Bloch, D. C. Hyland and D. J. Scheeres

MS in Applied Mathematics, University of Michigan, Ann Arbor, 2002

MS in Aerospace Engineering, University of Michigan, Ann Arbor, 2002

BS in Mechanical Engineering, Summa Cum Laude, American University in Cairo, 2000

Research Interests

Cooperative control of multi-agent sensor network systems, optimal control theory, nonlinear constrained dynamics and control

Teaching Experiences

Engineering Analysis and Computation, *Graduate Teaching Assistant*, AUC

Classical Mechanics, Sound and Heat, *Undergraduate Teaching Assistant*, AUC

Intro. to Relativity and Nuclear Physics, *Undergraduate Teaching Assistant*, AUC

Dynamics, *Undergraduate Teaching Assistant*, AUC

Professional Experiences

Software Engineer, 8/2002-12/2002, 4/2004-8/2004

MSC.Software Corporation, Ann Arbor, MI

Mechanical Engineer, 6/1999-9/1999

Technische Universität Clausthal, Clausthal-Zellerfeld, Germany

Awards and Honors

- **Best Student Paper Award Finalist**, 2004 American Control Conference, Boston, MA
- **Best Student Paper Award Finalist**, 2003 American Control Conference, Denver, CO
- Rackham Travel Grant, University of Michigan, 5/2002, 6/2003, 2/2004 and 6/2004
- Presidential Scholarship, American University in Cairo, 1997-1998 and 1999-2000
- On The Honor's Assembly List, American University in Cairo, 1997-2000
- On the Dean of Students Honor List, American University in Cairo, 1995-2000

Current Graduate Students

- Yue Wang

Professional Activities and Affiliations

Session Organization

- Sensor Network Control, Communication and Distributed Process Estimation I, 2007 American Control Conference (under review)
- Sensor Network Control, Communication and Distributed Process Estimation II, 2007 American Control Conference (under review)

Session Chair/Co-Chair

- Chair: Control of Nonholonomic Systems, 2006 American Control Conference, 6/2006
- Co-Chair: Optimal Control Applications, 2005 American Control Conference, 6/2005
- Co-Chair: Aerospace Applications II, 2005 IEEE Conference on Control Applications, 8/2005

Publications Referee

- Celestial Mechanics and Dynamical Astronomy, Proceedings of the IEEE, IEEE Transactions on Automatic Control, IEEE Transactions on Control Systems Technology, Journal of Guidance Control and Dynamics, Journal of Vehicle Systems Dynamics, Automatica, European Series in Applied and Industrial Mathematics: Control, Optimization and Calculus of Variations, The American Control Conference, and the Proceedings of the Institution of Mechanical Engineers, Journal of Aerospace Engineering, International Journal of Computer Mathematics

Academic Activities

- Engineering Academic Scholar, Academic Careers in Engineering and the Sciences Program, College of Engineering, University of Michigan, 2004
- Preparing Future Faculty Conference, University of Michigan, 2004
- Student Mentor, College of Engineering, University of Michigan, 2004-2005

Professional Society Membership

- Institute of Electrical and Electronics Engineers, 2004-present
- American Institute of Aeronautics and Astronautics, 2000-present
- American Society of Mechanical Engineers, 1998-present

Workshop Participation

- 2005 Quantum Control Summer School, Caltech, 8/2005
- Engineering Applications in Genomics, 2005 American Control Conference, 6/2005

Lectures and Invited Talks

- L-1.* Effective coverage control for mobile sensor networks with guaranteed collision avoidance. Department of Electrical and Computer Engineering, **Concordia University**, September, 2006.
- L-2.* Optimal control of second order systems on Riemannian manifolds. *Geometric Analysis and Applications Workshop*. Department of Mathematics, **University of Illinois**, IL, July 2006.
- L-3.* Effective coverage control for mobile multi-agent sensor systems. Department of Mechanical Engineering, **University of Houston**, Houston, TX, March 2006.
- L-4.* Effective coverage control for mobile multi-agent sensor systems. Department of Mechanical Engineering, **Worcester Polytechnic Institute**, Worcester, MA, March 2006.
- L-5.* Cooperative coverage control for mobile sensing networks. Department of Aerospace and Aeronautical Engineering, **Purdue University**, West Lafayette, November 2005.
- L-6.* Geometric optimal control theory with application to formation flight and interferometry. Coordinated Science Laboratory, **University of Illinois**, Urbana-Champaign, May 2005.
- L-7.* Optimal control of multi-spacecraft imaging formations. Department of Mathematics and Statistics, **Queen's University**, February 2005.
- L-8.* Interferometric observatories in low Earth orbit. *NRA Symposium*, **Jet Propulsion Laboratory**, June, 2002.
- L-9.* Various talks at the Flight Dynamics and Control Student Seminar, the Department of Aerospace Engineering, the **University of Michigan**, October, 2004, April, 2004, September 2003, and November, 2002.

Journal Papers

- JP-1.* I. I. Hussein, D. J. Scheeres and D. C. Hyland. Interferometric observatories in Earth orbit. *Journal of Guidance, Control and Dynamics*, Vol. 27, No. 2, pp. 297–301, 2004.
- JP-2.* B. Gillespie, V. Patoglu, I. Hussein and E. Westervelt. On-line symbolic constraint embedding for simulation of hybrid dynamical systems. *Multibody System Dynamics Journal*, Vol. 14, No. 3-4, pp. 387–417, November 2005.
- JP-3.* I.I. Hussein and D.J. Scheeres. Effects of orbit variations and J_2 perturbations on a class of Earth-orbiting interferometric observatories. *The Journal of the Astronautical Sciences*, Vol. 53, No. 2, pp. 147-166, 2005.
- JP-4.* I. I. Hussein, A. M. Bloch, D. J. Scheeres, D. C. Hyland and N. H. McClamroch. Optimal fuel-image motion planning for a class of dual spacecraft formations. *IEEE Transactions on Aerospace and Electronic Systems*, 2006. To appear.
- JP-5.* I. I. Hussein and A. M. Bloch. Dynamic coverage optimal control for multiple spacecraft interferometric imaging. *Journal of Dynamical and Control Systems*, 2006. To appear.

- JP-6.* I. I. Hussein and H. Schaub. The three-spacecraft Coulomb tether problem. *Celestial Mechanics and Dynamical Astronomy*, 2006. To appear.
- JP-7.* I. I. Hussein and D. Stipanović. Effective Coverage Control for Mobile Sensor Networks with Guaranteed Collision Avoidance. *IEEE Transactions on Control Systems Technology*, 2006. Accepted.
- JP-8.* I. I. Hussein, D. J. Scheeres and D. C. Hyland. Optimal formation design for imaging and fuel usage. *Journal of Guidance, Control and Dynamics*, 2006. To appear.
- JP-9.* I. I. Hussein and A. M. Bloch. Optimal control of under-actuated nonholonomic mechanical systems. *IEEE Transactions on Automatic Control*, 2006. To appear.

Journal Papers under Review and in Preparation

- JP-10.* I. I. Hussein, A. Sanyal, M. Leok and A. M. Bloch. Discrete variational optimal control problems on Lie groups. *Numerische Mathematik*. Submitted.

Refereed Conference Proceedings and Presentations

- CP-1.* I. I. Hussein, A. Sanyal, M. Leok and A. M. Bloch. A discrete variational integrator for optimal control problems on $SO(3)$. *2006 Conference on Decision and Control*. To appear. Preprint available upon request.
- CP-2.* I. I. Hussein and D. Stipanović. Effective coverage control for mobile sensor networks. *2006 IEEE Conference on Decision and Control*. To appear. Preprint available upon request.
- CP-3.* S. R. Lindemann, I. I. Hussein and S. M. LaValle. Real time feedback laws for nonholonomic mobile robots amongst obstacles. *2006 IEEE Conference on Decision and Control*. To appear. Preprint available upon request.
- CP-4.* I. I. Hussein and A. M. Bloch. Optimal control of under-actuated nonholonomic mechanical systems. *2006 American Control Conference*. To appear, 2006.
- CP-5.* I. I. Hussein and H. Schaub. The three-spacecraft Coulomb tether problem. *2006 Space Flight Mechanics Meetings*. Appeared, 2006.
- CP-6.* I. I. Hussein and A. M. Bloch. Constrained optimal trajectory tracking on the group of rigid body motions. *IEEE Conference on Decision and Control*, pp. 2152–2157, 2005.
- CP-7.* I. I. Hussein, D. Scheeres and D. Hyland. Optimal formation control for imaging and fuel usage with terminal imaging constraints. *IEEE Conference on Control Applications*, pp. 352–357, 2005.
- CP-8.* I. I. Hussein and A. M. Bloch. Optimal control of under-actuated systems with application to Lie groups. *The American Control Conference*, pp. 1472–1477, 2005.
- CP-9.* I. I. Hussein and A. M. Bloch. Dynamic coverage optimal control for interferometric imaging spacecraft formations (part II): The nonlinear case. *The American Control Conference*, pp. 2391–2396, 2005.

- CP-10.* I. I. Hussein, A. M. Bloch, D. J. Scheeres, D. C. Hyland and N. H. McClamroch. Optimal fuel-image motion planning for a class of dual spacecraft formations. *The American Control Conference*, pp. 2405-2410, 2005.
- CP-11.* I. I. Hussein, D. J. Scheeres and D. C. Hyland. Optimal formation control for imaging and fuel usage. *Space Flight Mechanics Meeting*, paper AAS 05-160, 2005.
- CP-12.* I. I. Hussein and A. Bloch. Dynamic coverage optimal control for interferometric imaging spacecraft formations. *IEEE Conference on Decision and Control*, pp. 1812-1817, 2004.
- CP-13.* I. I. Hussein and A. Bloch. Optimal control on Riemannian manifolds with potential fields. *IEEE Conference on Decision and Control*, pp. 1982-1987, 2004.
- CP-14.* I. I. Hussein and A. Bloch. Dynamic interpolation on Riemannian manifolds: An application to interferometric imaging. *The American Control Conference*, pp. 413-418, 2004.
- CP-15.* I. I. Hussein and D. J. Scheeres. Effects of orbit perturbations on a class of earth-orbiting interferometric observatories. *Space Flight Mechanics Meeting*, paper AAS 04-210, 2004.
- CP-16.* I. I. Hussein, D. J. Scheeres and D. C. Hyland. Control of a satellite formation for imaging applications. *The American Control Conference*, pp. 308-313, 2003.
- CP-17.* I. I. Hussein, D. J. Scheeres and D. C. Hyland. Formation path planning for optimal fuel and image quality for a class of interferometric imaging missions. *Space Flight Mechanics Meeting*, paper AAS 03-174, 2003.
- CP-18.* I. I. Hussein, D. J. Scheeres and D. C. Hyland. Interferometric observatories in earth orbit. *Space Flight Mechanics Meeting*, paper AAS 03-172, 2003.
- CP-19.* I. I. Hussein, S. L. Lacy and D. S. Bernstein. Data compression for subspace-based identification using periodic and nonperiodic inputs. *The American Control Conference*, pp. 3313-3318, 2002.

Conference Papers under Review and in Preparation

- CP-20.* I. I. Hussein and H. Schaub. Relative equilibria and their stability for the two-spacecraft Coulomb tether problem. *2007 IEEE Aerospace Conference*. Under review.
- CP-21.* I. I. Hussein, A. M. Bloch and F. Zeitz. Optimal motion planning for UAV radar evasion. *2007 American Control Conference*. Submitted.
- CP-22.* I. I. Hussein and D. Stipanović. Effective coverage control for mobile sensor networks with guaranteed proximity and collision avoidance. *2007 American Control Conference*. Submitted.
- CP-23.* I. I. Hussein and M. A. Demetriou. Estimation of distributed processes using mobile spatially distributed sensors. *2007 American Control Conference*. Submitted.
- CP-24.* I. I. Hussein. The Kalman filter and effective coverage control for domain mapping. *2007 American Control Conference*. Submitted.
- CP-25.* I. I. Hussein and A. M. Bloch. Stabilization of periodic orbits using the method of controlled Lagrangians. *2007 American Control Conference*. In preparation.

Thesis and Reports

- OP-1.* I. I. Hussein. Motion planning for multi-spacecraft interferometric imaging systems. Ph.D. dissertation, University of Michigan, 2005.
- OP-2.* I. I. Hussein and D. C. Hyland. Electric field reconstruction for separated spacecraft interferometry. Technical report, The University of Michigan, 2001.