

Shaunak D. Bopardikar

Embedded Systems and Networks
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- EDUCATION Ph.D., Mechanical Engineering, University of California Santa Barbara, USA, Sep. 2005 – Mar. 2010
- Thesis: Pursuit Strategies for Autonomous Vehicles
 - Advisers: Professor Francesco Bullo and Professor João P. Hespanha
- Dual Degree (B.Tech. + M.Tech.), Mechanical Engineering, Indian Institute of Technology, Bombay, Jul. 1999 – Jun. 2004
- Thesis: Design of an Artificial Human Knee Prosthesis
 - Adviser: Professor Bhartendu Seth
- HONORS AND AWARDS Best presentation in session, American Control Conference – 2007
- Academic Prize, Department of Mechanical Engineering, IIT Bombay – 2002
- Gold medalist at the Indian National Physics Olympiad – 1999
- Ranked 11 in the Higher Secondary School Certificate examination, Mumbai division – 1999
- Among top 0.5% in the Indian Institute of Technology's Joint Entrance Examination, India – 1999
- Among top 30 at the Indian National Mathematics Olympiad – 1998
- National Talent Scholarship, NCERT, India, 1997 – 2004
- RESEARCH INTERESTS Dynamic optimization, Game theory, Sampling techniques, Pursuit-evasion games, Vehicle routing, Control theory, Robotics.
- RESEARCH EXPERIENCE Senior Research Scientist/Engineer, United Technologies Research Center Inc., Berkeley, CA, USA May 2011 – Present
- **Optimization and Control methods for Design**
My research involves applying tools from optimization and control to solve applied problems in the areas of resource allocation, estimation, and abstraction-based design.
- Post-doctoral Researcher, University of California, Santa Barbara, Apr. 2010 – May 2011
- **Randomized methods for Large-sized Games**
We applied randomized methods to reduce computational requirements while providing probabilistic solutions to matrix games of large sizes. The effectiveness of our method was demonstrated by efficiently solving a hide-and-seek game that is known to exhibit exponential complexity.

Graduate Student Researcher, University of California, Santa Barbara, Sep. 2005 – Mar. 2010

- **Pursuit strategies for autonomous vehicles**

We studied pursuit-evasion problems in which one or many pursuers seek to capture an evader. Under constraints such as (i) limited range sensing or, (ii) motion constraints for the pursuers, we designed novel bio-inspired pursuer formations and provably correct strategies that guarantee capture of the evader.

- **Vehicle routing and placement for moving targets**

We designed a receding horizon policy for a vehicle to serve translating targets that arrive stochastically on a finite segment. Under some assumptions on the arrival process, we performed a complete stability characterization in the appropriate parameter space, and proved that in limiting regimes, the region of stability for our policy is within a constant factor of the optimal.

Research Assistant, Indian Institute of Technology, Bombay, May 2003 – Jun. 2004

- **Design of an Above-Knee prosthetic device**

We proposed a novel design and a control scheme in order that the dynamics of the prosthetic device mimics natural human gait. We built a prototype of the device and performed preliminary experiments to test the actual motion.

INDUSTRIAL EXPERIENCE

Summer Intern, UtopiaCompression Corporation, Los Angeles, CA, Jun. 2008 – Aug. 2008

- **Range estimation problems and novel compression techniques**

I assisted a team working on cutting-edge research in the area of motion analysis for range estimation. I was also a part of a group that worked on designing novel compression techniques for terrain modeling.

Engineer, General Electric India Technology Center, Bangalore, Aug. 2004 – May 2005

- **Stress analysis using Finite Element Method**

I was a part of the Rotating Parts group in Aircraft engines division. My responsibilities included (i) 2D and 3D modeling of aircraft engine components and, (ii) performing stress analysis using finite elements and, (iii) documentation of the obtained results.

Summer Intern, Larsen and Toubro India Limited, Bombay, May 2002 – Jun. 2002

- **Modeling of Machine parts**

I was a part of a team working on Heavy Engineering Equipment. My responsibilities included (i) a study and documentation of the various machine parts in an assembly and, (ii) making CAD models of these parts and their integration.

PUBLICATIONS **Journal Articles**

- [4] S. D. Bopardikar, S. L. Smith, and F. Bullo. **On Vehicle Placement to Intercept Moving Targets**. *Automatica*, 2011. Note: To appear.
- [3] S. D. Bopardikar, S. L. Smith, F. Bullo and J. P. Hespanha. **Dynamic vehicle routing for translating demands: Stability analysis and receding-horizon policies**. *IEEE Transactions on Automatic Control*, 55 (11), 2010.
- [2] S. D. Bopardikar, F. Bullo and J. P. Hespanha. **A cooperative Homicidal Chauffeur game**. *Automatica*, 45 (7), 2009.
- [1] S. D. Bopardikar, F. Bullo and J. P. Hespanha. **On Discrete-time Pursuit-evasion Games with Sensing Limitations**. *IEEE Transactions on Robotics*, 24 (6), 2008.

Conference Publications

- [14] J. T. Isaacs, S. D. Bopardikar, and J. P. Hespanha. **Dynamic Vehicle Routing over a Sparse Sensor Network**. In *INFORMS*, Charlotte, USA, Nov. 2011. Note: To be presented.
- [13] H. Jaleel, S. D. Bopardikar, and M. Egerstedt. **Towards Power-aware Rendezvous**. In *IEEE Conference on Decision and Control*, Orlando, FL, USA, Dec. 2011. Note: To appear.
- [12] A. Borri, S. D. Bopardikar, J. P. Hespanha, and M. D. Di Benedetto. **Hide-and-Seek with Directional Sensing**. In *International Federation of Automatic Control World Congress*, Milan, Italy, Aug. 2011. Note: To appear.
- [11] S. D. Bopardikar, and J. P. Hespanha. **Randomized Solutions to Partial Information Dynamic Games**. In *American Control Conference*, San Francisco, CA, USA, June 2011.
- [10] S. D. Bopardikar, A. Borri, J. P. Hespanha, M. Prandini, and M. D. Di Benedetto. **Randomized Sampling for Large Zero-Sum Games**. In *IEEE Conference on Decision and Control*, Atlanta, GA, USA, Dec 2010.
- [9] S. D. Bopardikar, S. L. Smith, and F. Bullo. **Vehicle placement to intercept moving targets**. In *American Control Conference*, Baltimore, MD, USA, Jun 2010.
- [8] S. L. Smith, S. D. Bopardikar, and F. Bullo. **A dynamic boundary guarding problem with translating demands**. In *IEEE Conference on Decision and Control*, Shanghai, China, Dec 2009.
- [7] S. L. Smith, S. D. Bopardikar, F. Bullo and J. P. Hespanha. **Dynamic vehicle routing with moving demands – Part II: High speed demands or low arrival rates**. In *American Control Conference*, St. Louis, MO, June 2009.
- [6] S. D. Bopardikar, S. L. Smith, F. Bullo and J. P. Hespanha. **Dynamic vehicle routing with moving demands – Part I: Low speed demands and high arrival rates**. In *American Control Conference*, St. Louis, MO, June 2009.
- [5] S. D. Bopardikar, F. Bullo and J. P. Hespanha. **A pursuit game with range-only measurements**. In *IEEE Conference on Decision and Control*, Cancun, Mexico, December 2008.
- [4] S. D. Bopardikar, F. Bullo and J. P. Hespanha. **A cooperative Homicidal Chauffeur game**. In *IEEE Conference on Decision and Control*, New Orleans, LA, December 2007.
- [3] S. D. Bopardikar, F. Bullo and J. P. Hespanha. **Cooperative pursuit with sensing limitations**. In *American Control Conference*, New York City, NY, July 2007.
- [2] S. D. Bopardikar, F. Bullo and J. P. Hespanha. **Sensing limitations in the Lion and Man problem**. In *American Control Conference*, New York City, NY, July 2007.
- [1] S. D. Bopardikar and B. Seth. **Design of an artificial leg mechanism for above-knee amputees**. In proceedings of the National Conference on Machines and Mechanisms, Guwahati, India, December, 2005.

TEACHING EXPERIENCE

- Teaching Assistant, Mechanical Engineering Department, University of California Santa Barbara, September 2005-March 2006, April-June 2008, April-June 2009
ME 155A - Control systems design, ME 163 - Vibrations
- Teaching Assistant, Mechanical Engineering Department, Indian Institute of Technology Bombay, July 2003-April 2004
ME 309 - Automatic control, ME 604 - Robotics

My responsibilities included (i) conducting tutorial sessions to address students' questions and, (ii) preparing homeworks and their solutions and lecture slides in consulta-

tion with respective instructors and, (iii) grading students' homeworks and exams.

PROFESSIONAL MEMBERSHIPS AND SERVICE

Member of IEEE and Control Systems Society

Reviewer for IEEE Transactions on Automatic Control, IEEE Transactions on Robotics, SIAM Journal on Control and Optimization, Robotics and Automation Magazine, Systems and Control Letters, IEEE Conference on Robotics and Automation, IEEE Conference on Decision and Control, American Control Conference, International Federation of Automatic Control (IFAC), Conference on Hybrid Control Systems and Computation.

Invited Session Co-organizer, 2009 American Control Conference, St. Louis, MO, USA.