Manish Kumar

Assistant Professor
Department of Mechanical Engineering
University of Cincinnati, OH
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Education

Ph.D.: Mechanical Engineering, Duke University, Sept. 2004
Dissertation: Sensor Fusion and Intelligent Control of Autonomous Cooperating Robots

MS: Mechanical Engineering, Duke University, May 2002
Thesis: Sensor Based Coordination and Control of Multiple Robots

B.Tech: Mechanical Engineering, Indian Institute of Technology, Kharagpur, India, 1998
Thesis: Development and Performance Evaluation of Silver Toughened Ceramic Tool

Experience

Assistant Professor — Sept. 2007 – present
University of Cincinnati, OH, USA

National Research Council Postdoctoral Research Associate — June 2005 – Aug. 2007
Army Research Office (ARO), NC, USA

Postdoctoral Research Associate — Nov. 2004 – Aug. 2007
Duke University, Durham, NC, USA

Visiting Scholar — Nov. 2006 – Jan. 2007
University of Pennsylvania, Philadelphia, PA, USA

Graduate Research Assistant — July 2000 – Aug. 2004
Duke University, Durham, NC, USA

Graduate Teaching Assistant — Jan. 2003 – Dec. 2003
Duke University, Durham, NC, USA

Design Engineer — July 1998 – June 2000
Hindustan Petroleum Corporation Limited, Bangalore, India

Research Interests

Robotics, Controls, Autonomous Cooperative Systems, Multi-Sensor Data Fusion, Distributed Systems

Honors and Awards

- National Research Council Associateship Award to carry out independent research supported by Army Research Office, 2005.
- Mechanical Engineering Graduate Research Award to support graduate studies at Duke University, 2000-2004.
- Duke University Graduate School Travel Award for participation in and paper presentation at the American Control Conference, 2004.
- ASME Dynamic Systems and Control Division (DSCD) Student Travel Award for participation in and paper presentation at the ASME International Congress and Exposition, 2002, 2003, and 2004.
- ASME Dynamic Systems and Control Division (DSCD) Student Travel Award for participation in and paper presentation at the American Control Conference, 2002, and 2004.
- Ranked in top 0.5% among 150,000 students who took Joint Entrance Exam (JEE) 1994 for selection into Indian Institutes of Technology.
- Selected to represent the state of Bihar, India for Indian National Mathematics Olympiad, 1993.

Affiliations and Service

- Member of American Society of Mechanical Engineers (ASME)
- Reviewed papers and articles for International Journals, Books, and Conferences including:
    - ASME Journal of Dynamic Systems, Measurement and Control
    - IEEE Sensors Journal
    - IEEE Transactions on Mechatronics
    - IEEE Transactions on Automation Science and Engineering
    - IEEE Transactions on Knowledge and Data Engineering
    - Information Sciences: An International Journal
    - International Journal of Control and Information Sciences
    - Journal of Intelligent and Fuzzy Systems
    - International Journal on Mechatronics
    - Encyclopedia of Computer Science and Engineering, Wiley Publications
    - American Control Conference
    - IEEE Conference on Decision and Control
    - ASME International Mechanical Engineering Congress and Exposition
    - ASME International Design Engineering Technical Conferences and Computer and Information in Engineering Conference
- Reviewed research proposals for the Army Research Office
- Member, Program Committee, Special Track on Multi-Robots at the Autonomous Agents and Multiagent Systems (AAMAS) Conference, 2008.
- Co-chair on Session on Networks, Security, and Agent based Systems at ASME's International Mechanical Engineering Congress and Symposium

Publications

Journal Publications

- **Kumar, M.**, Garg, D., and Kumar, V., "Segregation in a Swarm of Heterogeneous Agents", submitted to *IEEE Transactions on Automatic Control*, 2007.
- **Kumar, M.,** Garg, D., and Zachery, R., "A Method for Judicious Fusion of Inconsistent Multiple Sensor Data", *IEEE Sensors Journal*, Vol. 7, No. 5, pp. 723-733, May 2007.
- **Kumar, M.**, Garg, D., and Zachery, R., "Intelligent Sensor Uncertainty Modeling Techniques and Data Fusion", accepted for publication in *Control and Intelligent Systems*, 2008
- **Kumar, M.** and Garg, D., "Neuro-Fuzzy Controller Applied to Multiple Robot Cooperative Control", *Industrial Robot: An International Journal*, Vol. 32, Issue 3, 2005, pp. 234 – 239.
- **Kumar, M.** and Garg, D., "Sensor Based Estimation and Control of Forces and Moments in Multiple Cooperative Robots", *Transactions of the ASME Journal of Dynamic Systems, Measurement, and Control*, Vol. 126, Issue 2, June 2004, pp. 276-283.
- Garg, D. and **Kumar, M.**, "Optimization Techniques Applied To Multiple Manipulators for Path Planning and Torque Minimization", *Journal for Engineering Applications of Artificial Intelligence*, vol. 15, 2002, pp. 241-252.

Book Chapters

- **Kumar, M.** and Garg, D., "Neural Controllers", to appear in *Wiley Encyclopedia of Computer Science and Engineering*, (Benjamin Wah, Editor), John Wiley, New York, 2008.
- Garg, D. and **Kumar, M.**, "Multi Sensor Fusion in a Flexible Workcell Environment", *Mechatronics and Machine Vision 2002: Current Practice,* Research Studies Press Ltd., England, 2002, pp. 87-95.

Peer Reviewed Conference Publications

- **Kumar, M.** and Cohen, K., "Wild Land Fire Fighting Using Multiple Uninhabited Aerial Vehicles", submitted to 2008 ASME Dynamic Systems and Control Conference.
- Sarkar, S., Hall, E., and **Kumar, M.**, "Mobile Robot Path Planning Using Support Vector Machines", submitted to 2008 ASME Dynamic Systems and Control Conference.
- **Kumar, M.**, Garg, D., and Kumar, V., "Self-Sorting in a Swarm of Heterogeneous Agents", accepted for *American Control Conference*, 2008.
- **Kumar, M.**, Milutinović, D., and Garg, D., "Role of Stochasticity in Self-Organization of Robotic Swarms", accepted for *American Control Conference*, 2008.
- **Kumar, M.,** Garg, D., and Zachery, R., "Multiple Mobile Agents Control via Artificial Potential Functions and Random Motion", Paper No. IMECE2007-41521, *Proceedings of the ASME International Mechanical Engineering Congress and Exposition*, Seattle, WA, November 2007.
- Abhishek, A., **Kumar, M.**, and Garg, D., "Petri Net Based Modeling and Control Strategies for Flexible Manufacturing Systems", Paper No. IMECE2006-14678, *Proceedings of the ASME International Mechanical Engineering Congress and Exposition*, Chicago, IL, November 2006.
- Abhishek, A., **Kumar, M.**, and Garg, D., "Grasp Planning for a Two-Fingered Parallel Jawed Gripper", Paper No. IMECE2006-14654 *Proceedings of the ASME International Mechanical Engineering Congress and Exposition*, Chicago, IL, November 2006.

- **Kumar, M.**, Garg, D., and Zachery, R., "A Generalized Approach for Inconsistency Detection in Data Fusion from Multiple Sensors", *Proceedings of the American Control Conference*, Minneapolis, MN, 2006, pp. 2078 – 2083.
- **Kumar, M.**, Garg, D., and Zachery, R., "Stochastic Adaptive Sensor Modeling and Data Fusion", *Proceedings of SPIE Conference on Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems*, San Diego, CA, Feb-March 2006.
- **Kumar, M.**, Garg, D., and Zachery, R., "Intelligent Sensor Modeling and Data Fusion via Neural Network and Maximum Likelihood Estimation", Paper No. IMECE2005-80972, *Proceedings of the ASME International Mechanical Engineering Congress and Exposition*, Orlando, FL, November 2005.
- **Kumar, M.**, Garg, D., and Zachery, R., "Multi-Sensor Fusion Strategy to Obtain 3-D Occupancy Profile", *Proceedings of the 31st Annual Conference of the IEEE Industrial Electronics Society (IECON)*, Raleigh, NC, November 2005, pp. 2083 – 2088.
- **Kumar, M.** and Garg, D., "Three-Dimensional Occupancy Grid with the Use of Vision and Proximity Sensors in a Robotic Workcell", Paper Number IMECE2004-59593, *Proceedings of the ASME International Mechanical Engineering Congress and Exposition*, Anaheim, CA, November 14-19, 2004, 8p.
- Parimi, R., Garg, D., and **Kumar, M.**, "Genetic Q-Fuzzy Based Intelligent Control for Mobile Robot Navigation", Paper Number IMECE2004-60502, *Proceedings of the ASME International Mechanical Engineering Congress and Exposition*, Anaheim, CA, November 13-19, 2004, 8p.
- **Kumar, M.** and Garg, D., "Neural Network Based Intelligent Learning and Optimization of Fuzzy Logic Controller Parameters", Paper Number IMECE2004-59589, *Proceedings of the ASME International Mechanical Engineering Congress and Exposition*, Anaheim, CA, November 14-19, 2004, 8p.
- **Kumar, M.** and Garg, D., "Intelligent Learning of Fuzzy Logic Controller via Neural Network and Genetic Algorithm", Paper Number UL_029, *Proceedings of 2004 Japan USA Symposium on Flexible Automation*, Denver, CO, July 19-21, 2004, 8p.
- Jain, P., Garg, D., and **Kumar, M.**, "Universal Access to Multi-Robotic Workcell via World Wide Web", Paper Number UL_025, *Proceedings of the 2004 Japan-USA Symposium on Flexible Automation*, Denver, CO, July 19-21, 2004, 7p.
- **Kumar, M.** and Garg, D., "Intelligent Multi Sensor Fusion Techniques in Flexible Manufacturing Workcells", *Proceedings of American Control Conference*, 2004, Boston, MA, pp. 5375 – 5380.
- **Kumar, M.** and Garg, D., "Object Classification via Stereo Vision in a Flexible Manufacturing Work Cell", *Proceedings of the 10th International Conference on Mechatronics and Machine Vision in Practice*, Perth, Western Australia, December 9-11, 2003, 8p.
  Also published as: SME Paper Number TP04 PUB173, Society of Manufacturing Engineers, Dearborn, MI, 2004, 15p.
- **Kumar, M.** and Garg, D., "Fuzzy Logic Based Control of Multiple Manipulators in a Flexible Work Cell", Paper No. ISIC03-0232, *Proceedings of the International Symposium on Intelligent Control*, Houston, TX, October 5-8, 2003, pp. 399 - 404.
- **Kumar, M.** and Garg, D., "Multiple Cooperating Robots Dynamics and Fuzzy Logic Control for Internal Force Minimization", Paper No. DETC2003/VIB-45808, *Proceedings of the 19th ASME Biennial Conference on Mechanical Vibration and Noise, International Design Engineering Technical Conferences & Computers*, Chicago, IL, September 2-6, 2003, 8p.
- Garg, D. and **Kumar, M.**, "Genetic Algorithm based PD Control and Fuzzy Logic Control of a Two Link Robot", Paper No. IMECE2002-33433, *Proceedings of the ASME International Mechanical Engineering Congress and Exposition*, November, 2002, New Orleans, 8p.

- Garg, D. and **Kumar, M.**, "Multiple Robot Coordination Using Force/Torque and Vision Sensors", *IEEE Conference on Mechatronics and Machine Vision in Practice (M2VIP),* Thailand, 2002, pp. 142-151.
- Garg, D. and **Kumar, M.**, "Camera Calibration and Sensor Fusion in an Automated Flexible Manufacturing Multi Robotic Cell" *American Control Conference (ACC)*, Vol. 6, May 2002, Alaska, pp. 4934-4939.
- Garg, D. and **Kumar, M.**, "Optimal Path Planning And Torque Minimization via Genetic Algorithm Applied to Cooperating Robotic Manipulators", Paper No. DSC-24615, *Proceedings of the ASME International Mechanical Engineering Congress and Exposition*, November, 2001, New York.

Technical Report

- Garg, D. and **Kumar, M.**, "Sensor Modeling and Multi-Sensor Data Fusion", Final Progress Report for Project No. W911NF-01-10434 submitted to the Army Research Office (ARO), 2005.

Research Grants/Proposals

- Award winning National Research Council proposal entitled "Intelligent Multi-Sensor Modeling, Identification, and Data Fusion" for Research Associateship Program 2005.
- Assisted in preparing DURIP proposal entitled "Integrated Sensor Fusion Platform: Design and Experiments". Awarded by the DoD in April 2006.
- Assisted in preparing award winning (2004) NSF proposal entitled "Intelligent Multi-Sensor Modeling, Identification, and Data Fusion for Automated Manufacturing".
- Assisted in preparing STIR proposal entitled "Sensor Modeling and Multi-Sensor Data Fusion". Awarded by ARO in 2004.