

# Sachin Chitta

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## EDUCATION

**University of Pennsylvania**, Philadelphia, PA. (GPA: 4.0/4.0)

Ph.D. in Mechanical Engineering and Applied Mechanics, May 2005.

M.S. in Mechanical Engineering and Applied Mechanics, December 2000.

*Advisor:* Dr. Vijay Kumar

*Thesis:* "Dynamics and Control of a Class of Modular Locomotion Systems"

**Indian Institute of Technology**, Bombay, India (GPA: 8.47/10.0)

Bachelor of Technology in Mechanical Engineering, July 1999.

*Senior Design Thesis:* "Computer Control of an Electrohydraulic Servomechanism"

## RESEARCH EXPERIENCE

**GRASP Lab, Department of Mechanical Engineering and Applied Mechanics,  
University of Pennsylvania, Philadelphia, PA**

*Postdoctoral Associate, May 2005 – Present*

**Learning for Locomotion (<http://www.grasp.upenn.edu/LearningLocomotion>)**

**PIs: Dr. Dan Lee, Dr. Vijay Kumar**



- Developed and implemented learning based algorithms for quadruped walking over extremely rough terrain (a few orders of difficulty higher than the current state of the art). Learning used to choose appropriate footholds based on local terrain features and to improve global plans.
- Theoretical contributions also include a novel localization method for determining the pose of the robot given a terrain map using only proprioceptive sensors like onboard gyros, accelerometers and joint encoders.

**CKBot – Modular Robotic System (<http://www.grasp.upenn.edu/superbot>)**

**PI: Dr. Mark Yim**



- Led a team to implement the design, modeling, simulation and control of a highly mobile modular robot consisting of single degree of freedom modules with onboard power, control and communications for planetary exploration.
- Theoretical contributions include the development of a graph isomorphism based algorithm for automated configuration recognition and a shape changing algorithm for speed control of a dynamic rolling robot composed of multiple homogeneous modules.

**GRASP Lab, Department of Mechanical Engineering and Applied Mechanics,  
University of Pennsylvania, Philadelphia, PA**

*Graduate Research Assistant, Fall 1999 – May 2005*

**Dynamics and Control of a Class of Modular Locomotion Systems (PhD Thesis Work)**



- Developed algorithms to analyze the dynamics, generate gaits and carry out motion planning for locomotion systems with multiple locomotion modules subject to nonholonomic constraints.
- Implemented and validated gaits on a prototype Rollerblading robot including a novel non-anthropomorphic rotary gait and a novel single input robot called the RoboTrikke.

**RoboCup – Robot Soccer World Cup (Legged League)**

- Led the University of Pennsylvania **Upennalizers** Robot Soccer Team to 3<sup>rd</sup> place in Team Competition and 2<sup>nd</sup> place in Technical Challenge competition among 16 international teams at RoboCup 2001 in Seattle, Wa.
- Designed and implemented software architecture for game play, vision algorithms for ball, robot and marker detection and ranging, visual servoing algorithms for ball tracking, localization algorithms, omni-directional walking controller and multi-robot coordination.

## **Robotics Laboratory, Indian Institute of Technology, Bombay, India.**

*Research Assistant, Summer 1999*

Designed a new undergraduate lab in Mechatronics and Control for senior undergraduate students.

## **Robotics Division, BARC, India.**

*Summer Intern, Summer 1998*

Designed novel mechanisms for a robot to inspect narrow pipes in a power plant subject to severe size constraints.

## **Software**

- Development of C/C++/C# applications for robotic systems on Linux (C/C++) and Windows (C/C++/C#).
- Embedded software for onboard control, sensing and communications using the CAN protocol.
- Extensive experience with physical modeling and simulation using MATLAB, Mathematica, Maple.
- Extensive experience with building MEX interfaces and MATLAB GUIs for robotic applications.
- Experience with design using CAD software - ProEngineer, AUTOCAD.

## **Hardware**

Experience in designing distributed onboard control, sensing and communication systems using embedded controllers. Experience with using cameras for vision-based control and tracking.

## **Publications**

### **Journal Papers/ Book Chapters/ Technical Reports**

1. **Sachin Chitta** and Vijay Kumar, “Biking Without Pedaling”, in preparation for the ASME Journal of Mechanical Design.
2. **Sachin Chitta**, Frederik Heger, and Vijay Kumar, “Design, Analysis, Simulation and Experimental Results for a Rollerblading Robot”, in preparation for the International Journal of Robotics Research.
3. **Sachin Chitta**, Peng Cheng, and Vijay Kumar, “RoboTrikke: A novel undulatory locomotion system”, in preparation for the International Journal of Robotics Research.
4. Michael Park, **Sachin Chitta**, Alex Teichman and Mark Yim, “Automatic Configuration Recognition Methods in Modular Robots”, under review for the International Journal of Robotics Research.
5. Jimmy Sastra, **Sachin Chitta** and Mark Yim, “Dynamic Rolling for a Modular Loop Robot”, under review for the International Journal of Robotics Research.
6. **Sachin Chitta**, William Sacks, Jim Ostrowski, Aveek Das, and P. K. Mishra, “The University of Pennsylvania RoboCup Legged Soccer Team”, in A. Birk, S. Coradeschi, S. Tadokoro (Editors), *Lecture Notes in Computer Science 2377: RoboCup 2001: Robot Soccer World Cup V*, Springer Verlag, 2001.
7. Jim P. Ostrowski, Ken A. McIsaac, Aveek Das, **Sachin Chitta**, and Julie Neiling, “The University of Pennsylvania RoboCup Legged Soccer Team”, in P. Stone, T. Balch, G. Kraetzschmar (Editors), *Lecture Notes in Computer Science 2019: RoboCup 2000: Robot Soccer World Cup V*, Springer Verlag, 2000.
8. **Sachin Chitta** and J. Ostrowski, “Technical Report MS-CIS-01-08: Enumeration and motion planning for modular mobile robots”, Technical Report, Department of Computer and Information Science, University of Pennsylvania.

### **Refereed Conference Papers**

1. **Sachin Chitta**, Paul Vernaza and Daniel Lee, “Proprioceptive Localization for a Quadrupedal Robot on Known Terrain”, accepted to the *2007 IEEE International Conference on Robotics and Automation*, Rome, Italy.
2. **Sachin Chitta**, Mustafa Karabas, Kevin Galloway and Vijay Kumar, “RoboTrikke: Design, Modeling and Experimentation with a Robotic Trikke”, in *Proceedings of the 2006 ASME Design Engineering Technical Conference*, Philadelphia, Pennsylvania, 2006.
3. Jimmy Sastra, **Sachin Chitta** and Mark Yim, “Dynamic Rolling for a Modular Loop Robot”, in *Proceedings of the International Symposium on Experimental Robotics*, Rio Di Janerio, Brazil, 2006.
4. **Sachin Chitta** and Vijay Kumar, “Biking without pedaling”, in *Proceedings of the Fifth ASME International Conference on Multibody Systems, Nonlinear Dynamics and Control*, Long Beach, California, 2005.

5. **Sachin Chitta**, Peng Cheng, Emilio Frazzoli and Vijay Kumar, “RoboTrikke: A Novel Undulatory Locomotion System”, in *Proceedings of the 2005 International Conference on Robotics and Automation*, Barcelona, Spain, 2005.
6. **Sachin Chitta**, Frederik Heger and Vijay Kumar, “Design, Analysis, Simulation and Experimental Results for a Rollerblading Robot”, in *Proceedings of the 2004 ASME Design Engineering Technical Conference*, Salt Lake City, Utah, 2004.
7. **Sachin Chitta**, Frederik Heger and Vijay Kumar, “Design and Gait Control of a Rollerblading Robot”, in *Proceedings of the 2004 IEEE International Conference on Robotics and Automation*, New Orleans, 2004.
8. **Sachin Chitta** and Vijay Kumar, “Dynamics and generation of gaits for a planar Rollerblader”, in *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems*, Las Vegas, 2003.
9. **Sachin Chitta** and James P. Ostrowski, “Motion Planning for Heterogeneous Modular Mobile Systems”, in *Proceedings of the 2002 IEEE International Conference on Robotics and Automation*, Washington D.C., 2002.
10. **Sachin Chitta** and James P. Ostrowski, “New Insights into Quasi-Static and Dynamic Omnidirectional Quadruped Walking”, in *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems*, Maui, Hawaii, 2001.