

F R E D E R I K W. H E G E R

EDUCATION

Carnegie Mellon University, School of Computer Science, The Robotics Institute, Pittsburgh, PA

Ph.D. Candidate, Robotics (Advisor: Dr. Sanjiv Singh)

August 2004 – present

Master of Science, Robotics

May 2007

- Thesis research: Autonomous planning for robotic assembly of large structures in constrained environments
Planning for assemblies of structures larger than the workspace of the robot performing the task. The structures are subject to component ordering constraints, and the task takes place in a workspace that is tight relative to the goal configuration, which imposes feasibility constraints on potential actions. During planning, the structure is disassembled into increasingly detailed sub-assemblies to the level of individual components being moved cooperatively by a team of robots.
- TA for Kinematics, Dynamical Systems and Control graduate level course
- Tour guide for official and important visitors to the Robotics Institute

University of Pennsylvania, School of Engineering and Applied Science, Philadelphia, PA

Master of Science in Engineering, Mechanical Engineering and Applied Mechanics

May 2004

Bachelor of Science in Engineering summa cum laude, Mechanical Engineering and Applied Mechanics

December 2003

- Specialization in Robotics, research assistant at the GRASP (Penn robotics) lab
- TA for project-based senior/graduate-level mechatronics course
- Member and projects chair of the Science and Technology Wing (STWing) living and learning program
- Engineering peer advisor for incoming freshmen

RESEARCH AND WORK EXPERIENCE

Field Robotics Center, The Robotics Institute, Carnegie Mellon University

August 2004 – present

Graduate Research Assistant

- Ace Project – Mobile manipulation in an automotive assembly line setting
 - Work on the inside of cars inaccessible by traditional automotive assembly line robots to perform assembly, installation and cabling tasks
 - Hardware component selection, hardware design and system integration
- Institute for Dexterous Space Robotics – Assembly using space-rated hardware in a neutral buoyancy environment
 - Adaptation of task control capability developed for Trestle project to enable the Ranger robot to perform autonomous assembly of large-scale truss structure in simulated space conditions
 - Joint work with Stanford University and the Space Systems Laboratory at the University of Maryland
 - Hardware design, software development, field testing
- Trestle Project – Robots performing tightly coordinated tasks under a “sliding autonomy” paradigm
 - Development of the architectural framework necessary to coordinate robots performing complex assembly tasks
 - “Sliding Autonomy” allows blending of human intuition and flexibility with robot performance and efficiency to achieve both reliable and efficient operation of the team as a whole
 - Experimental validation using three heterogeneous robots in a large-scale assembly test bed
 - Software development, gripper modification and assembly component hardware development, system modeling, experimentation in multi-robot test bed, performance analysis and prediction, human subject studies
- In-Space Assembly and Repair Project – Heterogeneous robots performing space-relevant assembly tasks
 - Adaptation of architecture developed for Trestle project to support tasking and coordination of three heterogeneous robots developed at different NASA centers throughout their assembly mission
 - Joint work with NASA’s Johnson Space Center and NASA Jet Propulsion Laboratory
 - Task coordination software development, integration with NASA robots’ control software, implementation and testing

GRASP Laboratory, University of Pennsylvania

June 2002 – June 2004

Research Assistant (Advisor: Dr. Vijay Kumar)

- MARS (Multiple Autonomous Robots Software) Project
 - Cooperative navigation, localization and behavior of a group of autonomous ground robots. Integration of a 30ft autonomous blimp as aerial component to supplement and support the ground robots
 - Mechanical design and maintenance of blimp gondola, software development, field testing
- Rollerblading Robot (Mechanical Engineering Senior Design Project)
 - Design and implementation of a rollerblading robot that imitates human skating as its form of propulsion
 - Design, machining, manufacturing, modeling and simulation, control and software development, testing

Penn Psychology Perception Laboratory, University of Pennsylvania

October 2001 – August 2002

Administrative and Lab Assistant for Dr. David Brainard, Dr. Virginia Richards and Dr. Benjamin Backus

- PHP-MySQL implementation for Penn Perception homepage, MATLAB programming for vision experiments

SEW Eurodrive GmbH, Bruchsal, Germany

May 2001 – August 2001

Intern, Product Management Department

- Analysis and presentation of the results of a professional market research study on the projected development of PC-based control technologies between 2000 and 2004 as applicable to a manufacturer of electric motors

PUBLICATIONS

- Frederik W. Heger and Sanjiv Singh, "Sliding Autonomy for Complex Coordinated Multi-Robot Tasks: Analysis and Experiments," *Proc. RSS 2006*, Philadelphia, PA.
- Brennan Sellner, Frederik W. Heger, Laura M. Hiatt, Reid Simmons and Sanjiv Singh, "Coordinated Multiagent Teams and Sliding Autonomy for Large-Scale Assembly," *Proc. IEEE*, Vol. 94, No. 7, July 2006.
- Frederik W. Heger, Laura M. Hiatt, Brennan Sellner, Reid Simmons and Sanjiv Singh, "Results in Sliding Autonomy for Multi-robot Spatial Assembly," *Proc. iSAIRAS 2005*, Munich, Germany.
- Sachin Chitta, Frederik W. Heger and Vijay Kumar, "Design and Gait Control of a Rollerblading Robot," *Proc. ICRA 2004*, New Orleans, LA.
- Frederik W. Heger, "Design and Implementation of a Rollerblading Robot," Senior Design Project Final Report.
- Frederik W. Heger, "An Electric Propulsion System for an Autonomous Blimp," *PennScience Journal for Undergraduate Research*, Volume 1, Issue 1, Fall 2002.

PROFESSIONAL SERVICE AND AFFILIATIONS

- Reviewer for ICRA 2004, 2006
- Student Member of ASME and IEEE

LANGUAGES AND SKILLS

- Native German, fluent in English and French, proficient in Spanish
- Programming Languages: C, C++, C#, Java, SPARC Assembly, O'CamL, MATLAB, Maple, Mathematica, HTML, PHP
- Computer Skills: Pro/ENGINEER, LaTeX, MS Visual Studio, Windows, Mac, UNIX/Linux, some MySQL

HONORS AND AWARDS

- University of Pennsylvania
 - Francis G. Tatnall Prize in Mechanical Engineering and Applied Mechanics 2004 (best senior design project)
 - School of Engineering and Applied Science Faculty Appreciation Award 2003
 - School of Engineering and Applied Science Dean's List 2001-2002, 2002-2003
 - Herbert J. & Selma W. Bernstein Class of 1945 Summer Internship Recipient 2002
 - University Scholar (Research-based Honors Program), December 2002 – May 2004
- Honor Societies
 - Pi Tau Sigma, National Mechanical Engineering Honors Society
 - Tau Beta Pi, National Engineering Honors Society