The Center for In Situ Exploration and Sample Return (CISSR)
Speaker Series

presents

Speaker: James F. Montgomery

Topic: A Helicopter Testbed for Autonomous Vision-Guided Safe and Precise Landing

Date: Friday, March 22, 2002
Time: 1:30 - 3:00 p.m.
Location: JPL Bldg. 306-302

Abstract:

NASA's roadmap for solar system exploration is filled with missions that require landing on planets, moons, comets, and asteroids. Each mission has its own criteria for success, but all will require some level of safe and precise landing capability, possibly on hazardous terrain. Because of the communication delay induced by the large distances between the Earth and targeted bodies, landing must be done autonomously using onboard sensors and algorithms. Current technology does not provide the capability to land safely and precisely on hazardous terrain, so other techniques must be investigated.

In this talk, James Montgomery will discuss the development of machine vision algorithms and passive image-based control algorithms that enable safe and precise landing on hazardous terrain. These algorithms provide estimates of motion and position used to guide a lander during precision landing. They also enable hazard avoidance by providing estimates of 3-D surface topography through processing of monocular image streams followed by real-time decision making to assess hazards and select a safe landing site. This research will demonstrate closed-loop image-based safe and precise landing by integrating the above algorithms with an aerial testbed composed of a commercial model helicopter chassis, onboard processing

and multiple navigation sensors. This research was begun in FY'01, and James will discuss the results to date, show video of flight testing with the helicopter testbed, and have the helicopter on display at the talk.

Biography:

James F. Montgomery graduated from the University of Michigan in 1986 with a B.S. in Computer Science. He received his M.S. in 1992 and his Ph.D. in 1999, both in Computer Science, from the University of Southern California. His doctoral research investigated learning nonlinear control using a teaching-by-showing approach. He used this methodology to synthesize a fuzzy-neural control system for a helicopter using training data gathered while a teacher controlled the helicopter. Prior to coming to JPL, James worked as a software engineer at Hughes Aircraft Company for 13 years and at Raytheon Systems Company for 2 years. He is a Senior Member of Technical Staff in JPL's Machine Vision Group (Section 3452). James is leading an autonomous helicopter testbed effort, in which a radio-controlled model helicopter is outfitted with sensors, computers and algorithms to provide a platform for testing algorithms and systems in a more spacecraft-like environment. This testbed is currently being used for the Autonomous Vision-Guided Safe and Precise Landing task described in this talk.

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