Department of Electrical and Computer Engineering
Colorado State University

ECE SEMINAR: Wednesday November 7, 2007, 4:10 - 5:10 pm, Engineering B101

Optimal Fault Tolerant Design of Linearly Mapped Systems

Dr. John E. McInroy
Professor, Electrical and Computer Engineering Department
Director, Wyoming Robotics Initiative
University of Wyoming

Abstract. Many complex systems are described locally by linear mappings. For instance, in a robot manipulator, the mapping from joint velocities to end effector velocities is linear. Similarly, in a visual servoing application, the mapping from image feature velocities to object velocities is linear. Failures in these types of systems can often be modeled by removal of a row or column of the matrix describing the mapping. For instance, if a robot joint becomes stuck in one position, the column of the Jacobian matrix corresponding to that joint is removed. Similarly, if an image feature becomes occluded, the column of the visual Jacobian matrix corresponding to that feature is removed. The ratio of the Jacobian's nominal and failed determinant measures the degradation due to failure, and it is termed the relative manipulability for robotic systems, and the relative perceptability for visual systems. This talk will show that the mean squared relative manipulability/perceptability is always constant, *irrespective of the geometry*. As a result of this principle, *optimal fault tolerant manipulability/perceptability* is defined for manipulators as that geometry which maximizes the minimum manipulability/perceptability. Examples of robotic manipulators and visual systems which have been designed using this technique will be presented, along with an overview of the UW's robotics research.

Bio. John E. McInroy received the Ph.D. degree from Rensselaer Polytechnic Institute, Troy, NY, in 1991. During his graduate study, he was a Rensselaer Fellow, Xerox Fellow, and NASA Graduate Student Researchers Fellow. Following graduation, he joined the University of Wyoming, where he is currently a Professor of Electrical and Computer Engineering, and Director of the Wyoming Robotics Initiative. In 2001, he received the University of Wyoming's Outstanding Graduate Research and Teaching Award. He has been the Principle Investigator for grants totaling over five million dollars, and has held visiting appointments at the Kirtland Air Force Research Lab, University of Pennsylvania, NASA Jet Propulsion Laboratory, NASA Marshall Space Flight Center, and Xerox Corporation.

Contact: Prof. Anthony A. (Tony) Maciejewski, aam@colostate.edu