SEMINAR NOTICE

Department of Electrical and Systems Engineering

MINIMUM JERK TRAJECTORY PLANNING FOR A REDUNDANT MANIPULATOR USING PSEUDOSPECTRAL METHODS

DSc Preliminary Research Examination

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Abstract: In industrial applications there are many tasks that require high dynamic motion over large work envelopes. Examples include dispensing sealant, automated tape laying for composite fabrication, routing and trimming of large panels, and ultrasonic scanning for non-destructive defect inspection. In order to cover these work envelopes large manipulators are typically used. However, because of the massive links these robots lack the performance required for high dynamic trajectories, such as tight radius turns at speed and high-G acceleration at the start and stop of motions. One solution to this is to use a macro/micro manipulator configuration where a short stroke micro-manipulator with high dynamic performance is coupled to a large stroke macro manipulator to create a redundant robot with improved dynamic performance while retaining the work envelope of the large manipulator.

By introducing redundancy, the trajectory planning problem has an infinite set of solutions. We propose a procedure for minimizing the joint-space jerk of a redundant manipulator given an a priori specified path that the end-effector is required to follow. We formulate the problem as an optimal control problem in Bolza form and find the joint space trajectory that minimizes the square integral of the jerk for a foliation of self-motion manifolds along an interval of the path. The cost function is minimized using a pseudospectral numerical algorithm from optimal control theory. The method is illustrated for an example using a 5-link planar manipulator.

DATE:	Thursday, March 31, 2011
TIME:	1:00 p.m.
PLACE:	Bryan Hall, Room 305

Thesis advisor:
Dr. Heinz Schaettler

This seminar is in partial fulfillment
of the Doctor of Science degree

Washington University in St. Louis
SCHOOL OF ENGINEERING & APPLIED SCIENCE