SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

SUFFICIENT CONDITIONS FOR OPTIMALITY AND PERTURBATION FEEDBACK CONTROL IN OPTIMAL CONTROL PROBLEMS WITH FREE TERMINAL TIME WITH APPLICATIONS TO FLIGHT CONTROL PROBLEMS

DSc Preliminary Research Examination

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Abstract: Variational arguments and the ability to embed a controlled reference extremal into a local field of extremals are at the heart of local- and global-sufficient conditions for optimality in optimal control problems. In the engineering literature these arguments are related to the concept of perturbation feedback control and have been developed in the 1960's and 1970's in connection with the space program; however, most of this formalism is purely algorithmic especially when free terminal times are involved.

In this talk, a rigorous construction of a field of extremals is given for problems with a free terminal time. The most important aspect is the desingularization of the field of extremals at the terminal manifold which gives rise to a full understanding of its geometry. As a result, novel control-theoretic conditions based on local controllability that are weaker than formal computations used in the engineering literature are obtained. These local constructions near the terminal time are developed further into fields of extremals along a controlled reference trajectory. The focus of future research will be to extend the constructions to problems with control constraints, state-space constraints, and mixed control-state space constraints and to arrive at full descriptions of the corresponding field of extremals. The work combines and unifies various aspects of this construction, which hitherto only had been considered in isolation in the literature.

This work is motivated by flight control problems related to Ground Collision Avoidance Systems (GCAS) in which a control system needs to automatically return an aircraft to a safe orientation and speed from a dangerous flight path angle in order to protect an incapacitated pilot. Throughout the talk, a simplified version of the dynamics for an F-16 Fighting Falcon aircraft is used to illustrate the theory.

DATE: Thursday, April 26, 2018
TIME: 12:00 p.m.
PLACE: Green Hall, Room 0120

Dissertation advisor:
Dr. Heinz Schaettler

This seminar is in partial fulfillment
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