Math637
Optimal Control - Calculus of Variations

Time and location: TR 1:30-2:45pm, Keller 414
Book: Singular Trajectories and Their Role in Control Theory

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Office: Keller 311, 956-8464
Office hours: TR 9:30am-10:30am, by appointment

The topic for this class is the study of simple variational problems (first and second variation formulas), the Euler-Lagrange equation and optimal control. The class will be application oriented. The main goal is to provide the students with mathematical tools to analyze their own systems. It will be divided into two parts. Part 1: Linear systems, Part 2: Nonlinear systems.
Part 1. Linear Systems and the Time Optimal Control Problem

1. Accessibility Set and Controllability, Feedback Classification in the Autonomous Case and in the Nonautonomous Case
2. Time Optimal Control for Linear Systems

Part 2. Optimal Control for Nonlinear Systems

1. A Short Visit into the Classical Calculus of Variations (Hamiltonian Equations, Euler-Lagrange Equations, Second order equations, Scalar Riccati Equation)
2. Optimal Control and the Calculus of Variations (Related Problems, Optimal Control and the Classical Calculus of Variations, Singular Trajectories and the Weak Maximum Principle, Geometric Interpretation of the Adjoint Vector, Abnormality, The Weak Maximum Principle and Euler-Lagrange Equation, Comparison with the Calculus of Variations, LQ-Control and the Weak Maximum Principle, Pontryagin's Maximum Principle, Filippov Existence Theorem)

Examples from concrete applications will be also studied along with theory.

Grading policy (in percentage)

Final 35, Projects 35, Homeworks 30

Library

Books on Calculus of Variations are under quotation QA315- and book on Optimal Control are under quotation QA402.3-