0510.6301 Optimal Control

Credits: 3.

Prerequisites: Introduction to Modern Linear Control.

Problem formulation in the continuous and discrete time. Bolza, Lagrange and Mayer problems. Relation with calculus of variations. Historical tour.

Static optimization: necessary and sufficient conditions for extremum, Lagrange multipliers.

Calculus of variations: the basic variational problem, the central Lemma, Euler-Lagrange condition, Legendre condition. Constrained variational problem: constraints in the form of differential equations, isoperimetric problem.

Pontryagin minimum principle: continuous-time. LQR problem and Riccati equations. The tracking problem. Constrained input problems: minimum time, minimum fuel and minimum energy problems. Singular optimal control.

Dynamic programming: Bellman's principle of optimality, dicsrete-time and continuous-time problems. Hamilton-Jacobi-Bellman equation.

Necessary optimality conditions in the discrete-time: LQR problem and Riccati equations.

Introduction to differential games and H_∞ control.

Textbooks:

1. F. Lewis & V. Syrmos. Optimal Control Theory, Wiley , 1995.
2. D. Kirk. Optimal Control Theory, Prentice-Hall, 1970.
3. A. Bryson & Y. Ho. Applied Optimal Control, Hemisphere, 1975 (1999).
4. D. Bertsekas. Dynamic Programming & Optimal Control, 1995.
5. D Liberzon. Calculus of variations and optimal control theory. A concise introduction. Princeton University press. 2012.