Optimal Control with Applications to Aerospace Vehicles

Guest Seminar

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Monday, June 17th - Wednesday, June 19th 2019
10:00 – 13:00, MW 3618

The proposed lectures on “Optimal Control with Applications to Aerospace Vehicles” intend to cover theory of optimal control and trajectory optimization for dynamic systems with emphasis on its analysis, design and applications. Optimal control theory has become an important subject in aerospace engineering. The optimal control design approach offers a comprehensive framework to formulate a variety of stability, command-tracking, and path-planning problems in a unified manner. Such an approach not only naturally accounts for the various constraints, such as terminal and path constraints, that one must take into account while designing a controller/command, but also simultaneously optimizes a meaningful objective function, thereby leading to potential additional advantages. However, a severe drawback of the optimal control theory and trajectory optimization is that it often leads to a two-point boundary value problem and gets trapped in the curse-of-complexity issue, which demands computationally intensive procedures. The classical methods such as the gradient method, shooting method, etc. take significant amount of computational time and thus are suitable mainly for offline trajectory optimization problems. Hence, optimal control theory is rarely used in online applications. So, the computationally efficient optimal control techniques, which can be used particularly for the field of aerospace engineering, will be main focus of these lectures.

The lectures will cover the following topics:

1. Unconstrained and Constrained Optimization
2. Calculus of Variations
3. Constrained Optimal Control
4. Generalized Model Predictive Static Programming (GMPSP)
5. Unspecified final time GMPSP
6. GMPSP with control and state inequality constraints
7. Solutions of Practical Problems

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