AE551 Introduction to Optimal Control

☐ 교과목 개요

○ 국문

이 과목은 비행 궤적 최적화에 관련된 최적제어이론과 수치적 기법을 학습한다. KKT조건, HJB 방정식, 오일러-라그란지 방정식, 폰트랴긴 최소원리 등 정적/동적 최적화 문제에서의 최적성 조건에 대한 이론을 학습하고, 이를 수치적으로 해결하기 위한 비선형 프로그래밍, 동적 프로그래밍, 의사 스펙트럴 기법, 컨벡스 최적화 기법 등을 익히고, 간단한 예제에 적용한다.

○ 영문

This course addresses optimal control theory and associated numerical methods in the context of flight trajectory optimization. Students learn theoretical concepts on optimality condition in static & dynamic optimization problems, such as Karush-Kuhn-Tucker condition, Hamilton-Jacobi-Bellman equation, Euler-Lagrange equation, and Pontryagin's minimum principle; and then numerical methods such as nonlinear programming, evolutionary methods, pseudo-spectral method, and convex programming for simple applications.

☐ Syllabus

Week	Contents	Week	Contents
1	Optimal Control: Calculation of Variations	9	Parameter Optimization: Evolutionary Methods
2	Optimal Control: Necessary Conditions (E-L)	10	Numerical Solver: Hermite-Simpson Methods
3	Optimal Control: Necessary Conditions (HJB)	11	Numerical Solver: Psuedospectral Methods
4	Optimal Control: Linear Quadratic Controller	12	Numerical Solver: Psuedospectral Methods
5	Optimal Control: Indirect Numerical Methods	13	Numerical Solver: Convex Programming
6	Parameter Optimization: Optimality Conditions (KKT)	14	Numerical Solver: Convex Programming
7	Parameter Optimization: Gradient-Based Methods	15	Wrap-Up Sessions
8	Midterm Exam	16	Final Exam

☐ **Prerequites**

- No prerequisites. However, basic knowledge in the following disciplines will be helpful :
  - Linear Algebra
  - Calculus (Differential and Integral)
  - MATLAB (numerical experiments)

☐ **Course Materials**

- lecture slides

☐ **TA Tutoring**

- Q&A ZOOM session, once every week, evening time

☐ **Homework Assignments**

- 5 assignments at most

☐ **Tests**

- Quiz or Mid-Term Exam
- Final Exam or Term Project

☐ **Attendance Check**

- attendance rate to be reflected in the grade point

☐ **Grading**

- quiz (30%), final (30%), homework (30%), attendance (10%)