

ENG-639

**Dynamic programming and optimal control**

Summers Tyler

Cursus	Sem.	Type
Robotics, Control and Intelligent Systems		Opt.

Language of teaching	English
Credits	1
Session	
Exam	Project report
Workload	30h
<b>Hours</b>	<b>15</b>
Lecture	15
<b>Number of positions</b>	

**Remark**

Next time : Fall 2023

**Summary**

This course provides an introduction to stochastic optimal control and dynamic programming (DP), with a variety of engineering applications. The course focuses on the DP principle of optimality, and its utility in deriving and approximating solutions to an optimal control problem.

**Content**

Day 1

Lecture 1: Intro and Course Outline

Lecture 2: Mathematical Modeling Framework (Markov Decision Processes)

Lecture 3: The Principle of Optimality and Dynamic Programming (DP)

Day 2-3

Finite Space Systems

Lecture 4: Markov Chains

Lecture 5: DP for finite space Markov Decision Processes

Lecture 6: Coding DP (inventory and river flow examples)

Lecture 7: Infinite Horizon Problems, Value Iteration, Policy Iteration

Day 4-5

Continuous Space Systems and Linear Quadric Problems (LQ)

Lecture 8: Dynamic Programming in continuous space problems, curse of dimensionality, limitations

Lecture 9: DP in LQ problems

Lecture 10: LQ variations, time-varying, infinite horizon, multiplicative noise, dynamic games, etc.

Day 5-6

Approximate DP and Reinforcement Learning (RL) and Advanced Topics

Lecture 11: Approximate Dynamic Programming I (touch on MPC, RL)

Lecture 12: Approximate Dynamic Programming II (touch on MPC, RL)

Lecture 13: Supply Chain Example, Project Description

Lecture 14: Imperfect State Information (time permitting)

**Learning Prerequisites****Recommended courses**

linear algebra, probability theory, optimization, sufficient mathematical maturity