Course Overview

- Introduction
- Parametric Models
- Parameter Identifications
- Model Reference Adaptive Control
- Adaptive Pole Placement Control
- Adaptive Control for Non-linear Systems
Text Books

- Lecture notes

Grading

- Final  50%
- Projects  50%
History of Adaptive Control

- **1950’s**
  Autopilots for high-performance 
  **aircrafts** operating over a wide range of **speeds** and **altitudes**.

- **1960’s**
  Space state and stability theory.

- **1970’s-1980’s**
  Proof for stability of adaptive 
  control systems.
Control System

Plant Representation

Control system

Control System Design

Step 1: Modeling
Step 2: Controller Design
Problems

- Unknown plant model or parameters
- Plant parameters can vary with time!
- Unknown disturbance characteristics

- **Adaptive controller**: adapt to changes
- **To adapt**: to change a behaviour to conform to new circumstances.
Adaptive Controller

- A controller with adjustable parameters and a mechanism for adjusting the parameters.

Adaptive Control Design Strategies

- Identifier-based Adaptive Control
- Non-identifier-based Adaptive Control
Non-identifier-based Adaptive Control

- Gain Scheduling
- Switching Control
- Multiple Model Control

Gain Scheduling
Switching Control

- Switching between multiple models

Identifier-based Adaptive Control

- Model Reference Adaptive Control
- Self-Tuning Regulator
- PID control
Model Reference

Self-Tuning Regulator
Adaptive Control Strategies

- Indirect Adaptive control
- Direct Adaptive Control

Indirect Adaptive Control

- estimate plant parameters
- compute controller parameters
- relies on convergence of the estimated parameters to their true unknown values
Direct Adaptive Control

- no plant parameter estimation
- estimate controller parameters (gains) only

What kind of controller?
Thank You!