CALIFORNIA INSTITUTE OF TECHNOLOGY

Control and Dynamical Systems
CDS 270-I: System Identification and Adaptive Control

Annenberg 106, Fridays, 10 am – 11:55 am.
Spring 2016

Instructor

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Office Hours: Fridays, by appointment

Grading

Pass / Fail

Prerequisites

Linear systems and control, nonlinear dynamics, Lyapunov stability theory, and modeling of dynamical systems in MATLAB.

Course Outline

Mathematical treatment of System Identification methods for dynamical systems with aerospace applications will be covered.. Students will be asked to run a course project using models of their choice.

Project:

The course project will require to design, analyze, and simulate system identification algorithms applied to a nonlinear dynamical system. Project reports will be required and shall consist of both written and oral portions. The written portion of the report should be a detailed description of the selected topic using the terminology and notation from the class notes. Reports are due the first day of the finals week. Students will present their work in class, during the last week of the term.

Homework:

Homework assignments will be given once a week (Fri). Solutions are due the following week (Fri).

Grading Policy: **Pass (score 85% or higher) / Fail (otherwise)**

a) Class attendance ……. 10 %
b) Homework ……. 20 %
c) Project report ……. 60 %
d) Oral presentation of project …….. 10 %

Course material

1. Nonlinear dynamics and models for parameter identification.
2. The gradient estimator.
3. The Least-Squares estimator.
4. The Least-Squares estimator with exponential forgetting.
5. The normalized Least-Squares estimator with bounded gain forgetting.
6. System identification with adaptive predictors and state observers.
7. Parameter estimation in the presence of non-parametric uncertainties.
8. Adaptive control concepts.

Textbooks

1. Ioannou P.A., Fidan B., *Adaptive Control Tutorial*, SIAM, 2006.
2. E. Lavretsky, K.A. Wise, *Robust and Adaptive Control With Aerospace Applications*, Advanced Textbooks in Control and Signal Processing, Springer-Verlag, London, ISBN: 978-1-4471-4395-6 (Print), 978-1-4471-4396-3 (Online), 2013.

Supplementary Books

1. Narendra K.S., Annaswamy A.M., *Stable Adaptive Systems*, Dover, 2005.
2. Khalil H.K., *Nonlinear Systems*, 3rd Edition, Prentice Hall, New Jersey, 2002