MODELING AND SIMULATION II

TRACK: Cybernetics and control technology
ACADEMIC YEAR: 2023/2024, Winter Semester
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PURPOSE

Design and analysis of a wide spectrum of systems is enabled through the process of modeling and simulation. This course is focused on the application of this process, which comprises methods of mathematical analysis, stochastic simulation, validation, ... etc. Coursework is founded on smart grid case studies.

OUTLINE

The course includes 13 lectures with associated exercise sessions.

LECTURE PLAN

LEC01 22.9 - syllabus, case study, DES modeling.
LEC02 29.9 - UMDES library, model composition, properties.
LEC03 6.10 - allowable languages, rule based design, supervisors
LEC04 13.10 - intro to discrete Markov chains.
LEC05 20.10 - analysis of discrete Markov chains.
LEC06 27.10 - simulation of Markov chains.
LEC07 3.11 - Monte Carlo method
LEC08 10.11 - Markov Chain Monte Carlo.
LEC09 24.11 - hypothesis testing.
LEC10 1.12 - Wasserstein pseudo-metric, final project.
LEC11 8.12 - review.
LEC12 15.12 - reserved time for project consultation.

REQUIREMENTS

The course is graded on a curve. The final grade includes intermediate homework assignments and a final exam.

60% Assignments - DES 1/2 Markov Chains, Simulation
40% Final exam focused on methods of stastical validation.

RECOMMENED LITERATURE

Provided literature is made up of course notes, annotated source code, and technical articles. Note that not all material discussed in lecture is included in the lecture notes. Hence, the responsiblity is up to you to attain the taught materials. The following are the references.

J. A. Sokolowski and C. M. Banks (editors); Modeling and simulation fundamentals: Theoretical Underpinnings and Practical Domains; John Wiley & Sons, 2010. (Sokolowski ‘10)

L. G. Perez, A. J. Flechsig, and V. Venkatasubramanian; Modeling the Protective System for Power System Dynamic Analysis; IEEE Trans. on Power Systems, 9(4), 1994. (Perez ’94)

C. G. Cassandras and S. Lafortune; Introduction to Discrete Event Systems; Kluwer Academic Publishers, 1999. (Lafortune ‘99)

I. A. Hiskens and M. A. Pai; Trajectory Sensitivity Analysis of Hybrid Systems; IEEE Trans. on Circuits and Systems - Part I, 47(2), 2000. (Hiskens ’00)

I. A. Hiskens and P. J. Sokolowski; Systematic Modeling and Symbolic Assisted Simulation of Power Systems, 16(2), 2001. (Hiskens ‘01)

J. Lygeros; Lecture notes on hybrid systems; Department of Electrical and Computer Engineering; University of Patras, 2004.