

Instructor: Professor Asok Ray; Office Location: 329 Reber Building; Tel: 5-6377; email: axr2@psu.edu

Web Page Address: http://www.me.psu.edu/ray/graduate_courses.html

Instructional Objectives:

The objectives of this first-level graduate course are: (i) introduction to the theories of discrete-event and symbolic dynamics for modeling and control of complex systems in engineering applications; and (ii) preparation for advanced course work and research in information-based systems based on discrete-event and symbolic modeling, analysis, and control. The course is developed for graduate students and researchers in engineering and applied mathematics.

Course Outline:

Review of fundamentals of decision & control systems theory from continuously-varying and discrete-event perspectives. Role of continuously varying systems (CVS) and discrete-event systems (DES) in engineering applications. Introduction to the concepts of languages and symbolic dynamics. Classification of languages in Chomsky hierarchy. Examples of DES in dynamical systems from the perspectives of state estimation and diagnostics.


Timed automata and timed Petri nets. The clock structure and event timing dynamics. The $(\max, +)$ algebra for analysis of timed DES and timed marked graphs. Rudimentary concepts of hybrid control systems.

Computing Laboratory: Experiments on simulation of discrete-event processes for solving problems related to complex systems with mechanical engineering applications

Prerequisites: None

Reference Books:


J.D. Hopcroft and J.D. Ullman, Introduction to Automata Theory, Languages, and Computation, Addison Wesley, 1978


D. Lind and B. Marcus, Symbolic Dynamics and Coding, Cambridge University Press, 1995


