Fall 2012

Posted March 2012

AE450 (Flight Software Systems) [Atkins]

AE548 (Astrodynamics) [Cutler]

AERO 540 (ME 540) [Bernstein]

EECS 418 (Power Electronics)[Rivas]

EECS 419 (Electric Machinery and Drives)[Hofmann]

EECS 460 [Meerkov]

EECS 461 [Freudenberg]

EECS 498 [Revzen](Hands-on Robotics) (see flyer)

EECS 501 [Teneketzis]

EECS 566 [Lafortune](Discrete Event Systems) (see flyer)

EECS 598 [Hiskens] Power System Dynamics and Control

ME 548 [Orosz] Applied Nonlinear Dynamics (see flyer)

ME 560 [Stein]

ME 564 (AERO 550)(EECS 560) [Tilbury]

Math 658 [Bloch] (See flyer)

NA 483 [Sun] (Marine Control Systems)

NA 531 [Sun] Adaptive Control (MW 5:00-6:30)

Course Announcement FALL 2012

EECS 566 DISCRETE EVENT SYSTEMS

Instructor: Stéphane Lafortune
Room 4415 EECS, 763-0591
stephane@eecs.umich.edu
www.eecs.umich.edu/~stephane

Time: Tuesday-Thursday: 3:00 pm to 4:30 pm

Prerequisite: Graduate standing in EE:Systems, CSE, ME, AERO, or IOE

Description:

This course is intended for engineering and computer science graduate students who want to learn about dynamic systems with discrete state spaces and event-driven transitions. Discrete Event Systems, as they are called, arise in the modeling of technological systems such as automated manufacturing systems, communication networks, software systems, process control systems, and transportation systems. In embedded and networked systems, discrete event dynamics are coupled with continuous dynamics, giving rise to what are called Hybrid Systems or Cyber-Physical Systems. This course will introduce students to the modeling, analysis, and control of Discrete Event Systems. The primary emphasis will be on the logical, or untimed, behavior and associated verification and supervisory control problems. Timed Automata and Hybrid Automata will also be introduced. Examples from the above areas will be used throughout the course to illustrate the main concepts.

EECS 566 is a revised version of EECS 661. The 500-level number better reflects the level of the course. EECS 566 is also open to undergraduate seniors, but they should consult the instructor first.

There are no specific course prerequisites. 566 is offered in the fall semesters of even years.

(See over for more details)

Textbook: "Introduction to Discrete Event Systems - Second Edition" by C. Cassandras and S. Lafortune, Springer, 2008

Grading: Homework assignments, one midterm exam, and a final exam.

Syllabus: Most of Chapters 2, 3, 4, and 5 of textbook.

- Finite-state automata models: notions of deadlock and livelock; product and parallel composition; observer and diagnoser automata; analysis of safety and liveness properties.

- Petri net models: reachability analysis with coverability tree; structural analysis using incidence matrix.

- Supervisory control of systems modeled by automata: notions of controllability and observability; control under full and partial observation; nonblocking control.

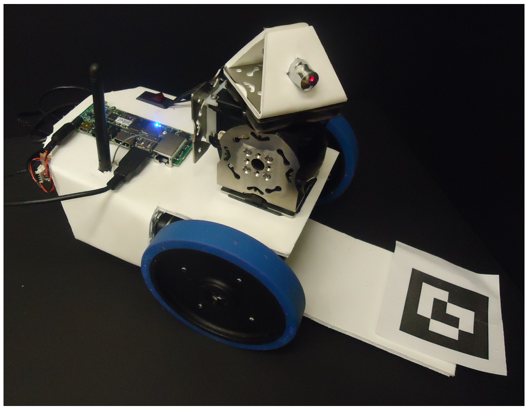
- Supervisory control of Petri nets by monitor places.

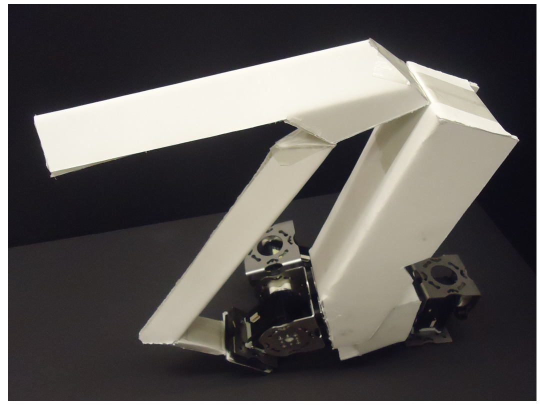
- Timed automata models: parallel composition; reachability analysis by untiming.

- Hybrid automata models of hybrid systems: basic notions.

Various software tools will be used in the course.

EECS 498 “Hands-On Robotics” (Revzen) learning robotics by construction





New in Fall 2012

Engineering seniors and grad students are invited to sign up for Hands On Robotics – a robotics course based on building robots using the CKBot modular robot system.

https://wiki.eecs.umich.edu/hrb

The course will cover basic concepts in Robotics: kinematics, control, programming and design. Grade is 80% team project reports; 20% quizzes. Class meets twice a week for two hours in the lab, with additional lab access provided for working on projects.

Open to EECS seniors and up; all other engineering and science seniors and graduate students with consent of instructor.

Mathematics 658

Nonlinear Dynamics and Mechanics

Instructor: Anthony M. Bloch.

Office: 4842 East Hall. Tel: 647-4980 Email: abloch@umich.edu

Webpage: http://www.math.lsa.umich.edu/˜ abloch

Fall Term, 2012, TTh 10-11.30

This course will discuss geometric aspects of the modern theory of ordinary differential equations and dynamical systems, with applications to various mechanical and physical systems. Topics will include: the qualitative theory of ODE's on manifolds, symplectic and Poisson geometry, nonlinear stability theory, Lagrangian and Hamiltonian mechanics, integrable systems, reduction and symmetries, mechanical systems with constraints and controls, and dissipative perturbations.

Recommended texts: The course will be drawn from several sources. The main text will be A. Bloch, Nonholonomic Mechanics and Control, Springer Verlag. Other books will be referenced as well as the primary mathematical literature.

Prerequisite: Some background in differential equations and some mathematical sophistication.

Grading: The course grade will be based mainly on completion of problem sets and general class participation.

ME548 APPLIED NONLINEAR DYNAMICS FALL 2012

Instructor: Prof Gábor Orosz
Department of Mechanical Engineering
Autolab G034, orosz@umich.edu

Lectures: M 3:30pm - 5:00pm, 1018 DOW
W 3:30pm - 5:00pm, 1018 DOW

Discussion: Th 4:30pm - 5:30pm, room TBA

Office hours: M 5:00pm - 6:00pm, 1018 DOW
W 5:00pm - 6:00pm, 1018 DOW
Tu 8:30am - 9:30am, Autolab G034

Prerequisites: An undergraduate level course in dynamics/vibrations/control, for example, ME360. You are expected to have knowledge of linear algebra and differential equations.

Course books: D. W. Jordan and P Smith, *Nonlinear Ordinary Differential Equations*, 4th edition, Oxford University Press, 2007 http://th.if.uj.edu.pl/~biernat/ksiazki/

Additional reading: J. Guckenheimer and P. Holmes, *Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields*, Springer, 1997

Y. A. Kuznetsov, *Elements of Applied Bifurcation Theory*, 2nd edition, Springer, 1998

P. Glendinning, *Stability, Instability and Chaos: An Introduction to the Theory of Nonlinear Differential Equations*, Cambridge University Press, 1994

S. H. Strogatz, *Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry and Engineering*, Perseus Books Publishing, 1994

M. Gruiz and T. Tel, *Chaotic Dynamics: An Introduction Based on Classical Mechanics*, Cambridge University Press, 2006

B. D. Hassard, N. D. Kazarinoff, and & Y.-H. Wan, *Theory and Applications of Hopf bifurcation*, Cambridge University Press, 1981

Course description: Geometrical representation of the dynamics of nonlinear systems. Stability and bifurcation theory for autonomous and periodically forced systems. Chaos and strange attractors. Introduction to pattern formation. Applications to various problems in rigid-body dynamics, flexible structural dynamics, fluid-structure interactions, fluid dynamics, and control of electromechanical systems.

Website: We will maintain a course website on which we will post material (assignments, solutions, handouts, etc.) as well as announcements. You can access our course website at https://ctools.umich.edu/portal

The Engineering Honor Code: http://www.engin.umich.edu/students/honorcode/
No member of the community shall take unfair advantage of any other member of the community.

Assignments: Eleven homework assignments will be set during the term that will be posted on the course's website. Homework sets are **due no later than the start of class on Wednesdays**, and late homework will NOT be accepted. The lowest homework score for the term will be dropped. Homework solutions will be available through the course web site. You are encouraged to discuss and work on homework together but the final document must represent your own understanding of the material.

Examinations: Midterm Exam: evening midterm TBA
Final Exam: Dec 17 (Mon), 4:00pm - 6:00pm

The exams will be closed book. One sheet of notes (8.5” by 11”) will be permitted for the exams (one-sided for the midterm and double-sided for the final).

Grading:	Homework	30%
	Midterm Exam	30%
	Final Exam	40%

No class on: Oct 15 (Mon) – Fall study break

Additional rules: no laptops, cell phones, ipods, ipads, etc. during the class

Course Schedule (tentative 3/31/12):

Week 01 – Constraints in mechanical systems, Lagrange equations of the second kind
Week 02 – State space representation, Linear stability
Week 03 – Lyapunov stabilitity, Domain of attraction, LaSalle-Krasowski invariance principle
Week 04 – Steady state bifurcations (saddle-node, pitchfork, transcritical), Catastrophe theory
Week 05 – Nonlinear oscillations in conservative systems, Forced nonlinear oscillations
Week 06 – Lienard and Bendixon Criteria, Hopf bifurcation, Normal form calculations
Week 07 – Stable and unstable manifolds, Center manifold reduction
Week 08 – Parametric excitation, Floquet theory, Mathieu Equation
Week 09 – Numerical continuation techniques
Week 10 – Pattern formation and Turing instability
Week 11 – Stroboscopic and Poincare maps
Week 12 – Sensitivity to initial conditions and Lyapunov exponents, Strange attractors and fractal dimension, Smale horsehoe and symbolic dynamics
Week13 – Chaotic vibrations in digital control