



Purdue University AAE 560: Systems-of-Systems Modeling & Analysis Spring 2020 Syllabus

Instructor

Dr. Daniel A. DeLaurentis
Professor
Office Hours: TBD

Office: ARMS 3225
ddelaure@purdue.edu
(765) 494-0694

Teaching Assistant

TBD; Office: ARMS "TBD"; TBD@purdue.edu

Office Hours: TBD; Webex available for Online students, link will be provided

Lecture: T/Th 9:00 a.m. – 10:15 a.m. in WANG 2579

Course websites and communication

Blackboard course website (<https://mycourses.purdue.edu/>) will be used to distribute course material (e.g., lecture notes, readings, homework), receive uploaded assignments from students, and track grades.

Piazza (<https://piazza.com/purdue/spring2020/aae560/home>) will be used for all class discussions and all submission/response to questions about lectures, homework, etc. There is also a section on Piazza for feedback on the draft textbook we will be using. NOTE: Any emails to the teaching team MUST start with "AAE560" in the subject line, otherwise they will not be answered. You should only email the TAs about logistics specific to you (e.g., needed a HW extension, setting an appointment); all other queries should be posted on Piazza so that all students can benefit from the answers. If you have a question on a HW, for example, first search the discussion thread on Piazza for that assignment before posting anew

Course description

The goal for this course is to enable students to characterize, abstract, model, simulate, and analyze a special kind of system termed a "system-of-systems" (SoS). The course will cover a select few topics in detail, but also expose students to interesting areas of further study and highlight the importance of SoS in society. The course presents recent developments in frameworks for formulating system-of-systems problems, lexicon for their articulation, and analysis methodology for their study. Through individual and team projects, students gain experience in formulating problems and applying theory and techniques. Applications for team projects will include transportation, space exploration, energy, defense, and infrastructure, though others are possible in consultation with instructor.

Course objectives

At the completion of this course, successful students will be able to:

- Recognize distinctive traits of a system-of-systems
- Understand the implications of these traits on modeling and operation
- Formulate system-of-systems design problems
- Develop/use appropriate modeling & analysis methods for these problems (emphasis: *networks and agent-based modeling*)
- Synthesize solution candidates for relevant decision criteria including *complexity*; explore *validity*
- Articulate problem formulation, analysis, and solution in written and verbal formats

Textbook

- A "in progress draft" of a textbook on SoS Modeling and Analysis will be given to students as primary reading/primary lecture notes, along with numerous journal papers assigned as required reading and augmented with powerpoint slides for lecture topics. No other textbook is required.
- Suggested Reading: several books and resources will be suggested for the interested student looking for deeper exposure to specific topics, e.g., Modeling Complex Systems, Nino Boccara, 2004, Springer Series Graduate Texts in Contemporary Physics, ISBN 0 – 387 – 40462 - 7

Grading

Team Project	25%
Homework Assignments	30%
(one) Midterm Exam	20%
Regular Online Assessments	20%
Participation (In class, online discussion threads)	5%

Project

Working in teams of 3-4 people, the team project allows students to demonstrate knowledge of key concepts through application, culminating in a final report and presentation. Students will self-select into teams according to their interest in project topics provided by instructor (or self-generated, in consultation with instructor). Teams must successfully apply the DAI approach to SoS modeling presented in class. More details are given in the document 'Project Guidelines'.

Homework Assignments and Assessments

Three to four Homework assignments will be given during the course of the semester. These assignments will require in-depth work and provide opportunity for the students to demonstrate skill with course concepts. The weekly online assessments consist of multiple choice questions meant to ensure that the student is reading assigned materials and following lecture. The assessments will be administered via the Blackboard Learn course website.

Mid-Term Exam

The one exam will be open book/notes, take-home style; thus, proctors for distance students will NOT be required (unless otherwise specified). **There is no Final Exam.**

Readings

Many! Separated into REQUIRED and SUPPLEMENTARY (most are already loaded on the Blackboard course web site; some will be added as topics arise in class.).

Software

Students are expected to be capable (not expert) in MATLAB or equivalent scientific programming environments. Other software may be used that is a) appropriate to the modeling needs of their project, b) available to all Purdue students via ECN or ITAP, or is freeware. The following have been used in the past, others may be selected as needed by teams:

- Pajek (<http://pajek.imfm.si/doku.php>)
- UCINET (<http://www.analytictech.com/ucinet/ucinet.htm>)
- Microsoft Excel
- Netlogo (<http://ccl.northwestern.edu/netlogo/>) → ABM
- Netlogo (<https://ccl.northwestern.edu/netlogo/docs/systemdynamics.html>) → Sys Dynamics
- AnyLogic or Vensim (<http://www.vensim.com/software.html>) → trial versions *might* be useful

Academic Dishonesty

Purdue prohibits “dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty.” [Part 5, Section III-B- 2-a, University Regulations] Furthermore, the University Senate has stipulated that “the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest.” [University Senate Document 72-18, December 15, 1972]

Use of Copyrighted Material

Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise. Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally. Notes taken in class are, however, generally considered to be derivative works of the instructor’s presentations and materials, and they are thus subject to the instructor’s copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor. To obtain permission to sell or barter notes, the individual wishing to sell or barter the notes must be registered in the course or must be an approved visitor to the class. Course instructors may choose to grant or not grant such permission at their own discretion, and may require a review of the notes prior to their being sold or bartered. If they do grant such permission, they may revoke it at any time, if they so choose.

Grief Absence Policy for Students

Purdue University recognizes that a time of bereavement is very difficult for a student. The University therefore provides the following rights to students facing the loss of a family member through the Grief Absence Policy for Students (GAPS). GAPS Policy: Students will be excused for funeral leave and given the opportunity to earn equivalent credit and to demonstrate evidence of meeting the learning outcomes for missed assignments or assessments in the event of the death of a member of the student’s family.

Violent Behavior Policy

Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activity.

Students with Disabilities

Purdue University is required to respond to the needs of the students with disabilities as outlined in both the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 through the provision of auxiliary aids and services that allow a student with a disability to fully access and participate in the programs, services, and activities at Purdue University. If you have a disability that requires special academic accommodation, please make an appointment to speak with me within the first three (3) weeks of the semester in order to discuss any adjustments. It is important that we talk about this at the beginning of the semester. It is the student’s responsibility to notify the Disability Resource Center (<http://www.purdue.edu/drc>) of an impairment/condition that may require accommodations and/or classroom modifications.

Nondiscrimination

Purdue University is committed to maintaining a community which recognizes and values the inherent

worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, genetic information, marital status, parental status, sexual orientation, gender identity and expression, disability, or status as a veteran. The University will conduct its programs, services and activities consistent with applicable federal, state and local laws, regulations and orders and in conformance with the procedures and limitations as set forth in Executive Memorandum No. D-1, which provides specific contractual rights and remedies. Any student who believes they have been discriminated against may visit www.purdue.edu/report-hate to submit a complaint to the Office of Institutional Equity. Information may be reported anonymously.

Emergencies

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

Emergency Preparedness

EMERGENCY NOTIFICATION PROCEDURES are based on a simple concept - if you hear a fire alarm inside, proceed outside. If you hear a siren outside, proceed inside. * Indoor Fire Alarms mean to stop class or research and immediately evacuate the building. * Proceed to your Emergency Assembly Area away from building doors. Remain outside until police, fire, or other emergency response personnel provide additional guidance or tell you it is safe to leave. * All Hazards Outdoor Emergency Warning Sirens mean to immediately seek shelter (Shelter in Place) in a safe location within the closest building. * "Shelter in place" means seeking immediate shelter inside a building or University residence. This course of action may need to be taken during a tornado, a civil disturbance including a shooting or release of hazardous materials in the outside air. Once safely inside, find out more details about the emergency*. Remain in place until police, fire, or other emergency response personnel provide additional guidance or tell you it is safe to leave. In both cases, you should seek additional clarifying information by all means possible...Purdue Emergency Status page, text message, email alert, TV, radio, etc...review the Purdue Emergency Warning Notification System multi-communication layers at <http://www.purdue.edu/ehps/emergency-preparedness/warning-system.html>

EMERGENCY RESPONSE PROCEDURES: * Review the Emergency Procedures Guidelines <https://www.purdue.edu/emergency-preparedness/flipchart/index.html> * Review the Building Emergency Plan (available on the Emergency Preparedness website or from the building deputy) for: * evacuation routes, exit points, and emergency assembly area; * when and how to evacuate the building; * shelter in place procedures and locations; * additional building specific procedures and requirements.

EMERGENCY PREPAREDNESS AWARENESS VIDEOS: * "Shots Fired on Campus: When Lightning Strikes," is a 20-minute active shooter awareness video that illustrates what to look for and how to prepare and react to this type of incident. See:

<http://www.purdue.edu/securePurdue/news/2010/emergency-preparedness-shots-fired-on-campusvideo.cfm> (Link is also located on the EP website) MORE INFORMATION Reference the Emergency Preparedness web site for additional information:

<https://www.purdue.edu/ehps/emergency-preparedness/>