



Welcome to the AA/EE/ME 597 website! The site will be updated throughout the quarter, please come back and visit often.

Course Description

This course examines graph-theoretic techniques that have been instrumental for studying dynamic systems which coordinate their states over an information-exchange network, such as robotic teams, formation flight, biological networks, and distributed estimation.

Topics include network models, network spectral properties, dynamics over networks, formation control, biological networks, observability, controllability, and performance measures over networks.

The course can also be watched online at <http://moodle.extn.washington.edu>.

Prerequisite: AA/ME/EE 547 or working knowledge of linear algebra, basic linear systems theory and Matlab.

Contacting Us

Email: [airliec \(at\) uw \(dot\) edu](mailto:airliec@uw.edu)

Phone: 206 543 6181

The best way to get a hold of me is on the discussion board or by email, which I should be checking between Mon-Fri 12-5pm. There are no guarantees outside of these times.

TA: Prachya Panyakeow

Email: [prachya \(at\) uw \(dot\) edu](mailto:prachya@uw.edu)

Office Hours

Mine:

Tuesdays 11-12.30, Guggenheim Room 318F (if popular we'll relocate to Room 305)

Thursdays 11-12.30, Guggenheim Room 318F (if popular we'll relocate to Room 305)

Online Students: I'm available by phone and skype during office hours and by appointment.

TA:

Mondays 1-2:30, Guggenheim Room 312

Wednesdays 1-2:30, Guggenheim Room 312

Textbook

Mehran Mesbahi and Magnus Egerstedt. [Graph Theoretic Methods in Multiagent Networks](#), Princeton University Press, 2010.

Availability: Online Copy are on UW library website, Hardcopies are at the U Bookstore, Amazon, etc.

Book Website: <http://sites.google.com/site/mesbahiegerstedt/> This is a great resource with other versions of the course, references and book errata!

Assessments

The assessments and their grade break down are:

Multiple choice online quizzes 10%

Weekly homework 35%

Midterm 30%

Research Project 25%

All assessments are due at 11:59pm PST on the posted date except the midterm.

Multiple Choice Online Quizzes

Multiple choice quizzes will be set after each lecture and available for completion on the [Catalyst](#) website. They will be quick assessment of the course material taught in the lecture and will be short.

NB: Make sure your Catalyst filter is allowing the quizzes to go through by selecting "WebQ".

Due: The quizzes for each week will be due the following Tuesday at 11:59pm. Please see the schedule below for exact dates.

Homework

Weekly homework will be posted below on the schedule. It will be composed of applications, proofs and computational exercises. Please submit in class or on [Catalyst](#) on Thursday.

There will be no homework due the week of the midterm.

Homeworks can be discussed and worked on in groups but your write up must be your own!

Due: The homework for each week will be due on Thursday at 11:59pm. Please see the schedule below for exact dates.

Midterm

The midterm will be an in-class exam on Thursday May 8th.

For off-campus students who can not make it into campus for the exam please refer to <http://www.engr.washington.edu/pce/exams.html> to nominate a proctor for your exam.

Details: The exam is closed book/closed notes except for a single letter paper with writing on one side. No calculators and bring your own paper. It will be based on all material up until and including May 1st (Passivity class).

Research Project

The project involves selecting a journal or conference publication and preparing a report of that work. The report will be due during the exam week.

Paper Selection: Papers should be selected that align with the themes of the course. Those referenced on the website and in the text are fine but feel free to select other papers as well, just check with me for

approval. Papers can be challenging to comprehend and may build on resources not covered in the course. Come talk to me if you get stuck and I'll do my best to help.

A great list of possible papers by topic can be found at the bottom of <http://faculty.washington.edu/mesbahi/pmwiki/pmwiki.php?n=Main.AA-EE-ME597NetworkedDynamicSystems>

Upload the title of the paper and a few sentences describing why the paper is suitable for the research project. Also attach the paper itself.

Due: The paper selection material (white paper) is due Tuesday, May 13 at 11:59pm.

Report: The report should be a 4-5 pages pdf + Appendix of simulations, matlab code etc. The style of the report can be found http://control.disp.uniroma2.it/cdc2012/author_info.php (either tex or word).

The basic structure of the report is:

1. Introduction - Outline what the paper is about and where it is placed in the field. What does it demonstrate? How does it fit into the topic of the course and the general area?
2. Background - Present the specific mathematical tools, notation and definitions required for the paper.
3. Main contribution - Discuss the main results of the paper including both high level interpretations and mathematically rigorous explanations of key steps in the proofs.
4. Simulations - Replicate or illustrate the key results found in the paper.
5. Conclusion and thoughts - Critique the work and if you can propose extensions of the ideas

Presentation (optional): There is an optional 15min presentation of your report in the final week of class. The goal is to teach the main points of the paper to the class. The presentation should be structured similar to the report.

As an incentive to selecting this option your final report will be due on the Friday of the exam week. If off-campus students would like to select this option they are free to present in either of the final two lectures of the quarter or submit a recording of their presentation.

Due: Without a presentation - Report is due Tuesday of the exam week at 11:59pm. With a presentation - Report is due Friday of the exam week at 11:59pm.

Schedule

Date	Lecture Topic	Reading	Quizzes/ Homework
Tue, April 1	Course Description and Graph Introduction	Chap. 1,2,1	Quiz 1 Released (due April 8)
Thu, April 3	Representing Graphs and Exploring Rendezvous	Chap. 2.3,3.1	Quiz 2 Released (due April 8),

Date	Lecture Topic	Reading	Quizzes/ Homework
			Homework 1 Released (due April 10)
Tue, April 8	Rendezvous convergence and Laplacian spectrum	Chap. 2.4 (no 2.4.2),3.1	Quiz 1 and 2 Due at 11:59pm Quiz 3 Released (due April 15)
Thu, April 10	Introducing digraphs and directed rendezvous	Chap 2.2,3.2	Homework 1 Due at 11:59pm Homework 2 Released (due April 17) Quiz 4 Released (due April 15)
Tue, April 15	Characteristics of directed rendezvous	Chap 3.2	Quiz 3 and 4 Due at 11:59pm Quiz 5 Released (due April 22)
Thu, April 17	Switching Graphs	Chap 4.1,4.2	Homework 2 Due at 11:59pm Homework 3 Released (due April 22) Quiz 6 Released (due April 22)

Date	Lecture Topic	Reading	Quizzes/ Homework
Tue, April 22	Switching Graphs, Formation Control	Chap 4.2,6.1 (no rigidity)	Quiz 5 and 6 Due at 11:59pm Quiz 7 Released (due April 29)
Thu, April 24	Formation Control	Chap 6.2,6.4	Homework 3 Due at 11:59pm Homework 4 Released (due May 1) Quiz 8 Released (due April 29)
Tue, April 29	Control of Unicycles	Chap 6.4	Quiz 7 and 8 Due at 11:59pm Quiz 9 Released (due May 6)
Thu, May 1	Passivity	Chap 4.4 (only spanning trees, i.e., $R=I$)	Homework 4 Due at 11:59pm Quiz 10 Released (due May 6) No Homework for next week White Paper submission site open

Date	Lecture Topic	Reading	Quizzes/ Homework
Tue, May 6	Distributed Estimation, Projects	Chap 8.1	Quiz 9 and 10 Due at 11:59pm Quiz 11 Released (due May 13)
Thu, May 8	Midterm		Homework 5 Released (due May 15)
Tue, May 13	Mobile Robotics	Chap 7	Quiz 11 Due at 11:59pm White Paper Due at 11:59pm
Thu, May 15	Mobile Robotics		Homework 5 Due at 11:59pm
Tue, May 20	Controlling Networks	Chap 10	Quiz 12 and 13 Due at 11:59pm
Thu, May 22	Controlling Networks		Homework 6 Due at 11:59pm
Tue, May 27	Network Synthesis	Chap 11	Quiz 14 and 15 Due at 11:59pm
Thu, May 29	Social networks and games	Chap 9	Homework 7 Due at 11:59pm
Tue, Jun 3	Social networks, Presentations Day 1		Quiz 16 and 17 Due at 11:59pm

Date	Lecture Topic	Reading	Quizzes/ Homework
Thu, Jun 5	Presentations Day 2		Homework 8 Due at 11:59pm
Tue, Jun 10	Exam Week (No Exam)		Final project due for non- presenters at 11:59pm
Fri, Jun 13			Final project due for presenters at 11:59pm