CEE 501 – Deployable and Reconfigurable Structures
Winter 2020 – Syllabus

Instructor: Evgueni T. Filipov   -   Office: 2144 GG Brown   -   Email: filipov@umich.edu

Lectures: Mon. Wed. 2:30pm – 4:00pm, 2153 GG Brown

Office hours: Mon. Wed. 4:00pm – 5:00pm, 2144 GG Brown

Course Description: This course covers the theory, analysis, and design of deployable and reconfigurable structures. A review of existing and emerging structural systems will cover bar linkages, pantographs (scissor mechanisms), origami structures, and bi/multi-stable units. Conceptual topics will include deployment kinematics, stability, geometric constraints, mechanical behaviors, energy formulations, and matrix analysis of the systems. Practical areas discussed in the course will include structural design, material systems, actuation technologies, and fabrication methods. The course will include a student project to explore engineering applications of the structures in architecture, aerospace, robotics, and beyond.

Prerequisites: Exposure to the following topics: matrices and vectors, linear algebra, and matrix structural analysis. CEE 412 Matrix Structural Analysis or CEE 510 Finite Element Methods, or a similar class is strongly recommended. Basic knowledge of MATLAB is required.

Target audience: Advanced undergraduate and graduate students are encouraged to enroll in the class.

Grading: Homeworks 25%; Midterm 25%; Readings 10%; Class Project Report 25%; Class Project Presentation 15%. These weights are approximate; the right to change them later is reserved.

Lectures: A lecture schedule is available on canvas and lists the topics for the semester. The schedule will be revised and updated as necessary.

Participation: Regular class attendance and participation is expected. There will be in class reading discussions and occasional in-class activities that will be collected during class.

Homework: Generally, homework problems are assigned on Mondays and are due two weeks later on Friday by 5pm (see schedule). Submit homework via Gradescope (see below). Homework submitted after the Friday 5pm Deadline will only be eligible for 50% of the total grade, any homework not submitted by Sunday at 10pm will receive a grade of 0%. You are encouraged to discuss homework with your classmates, but everything you submit should constitute your own work and reflect your own understanding. Homework will often involve MATLAB programming.

Readings: A set of research papers related to deployable and reconfigurable structures will be provided by the instructor. Students are required to read those papers, and prepare a short summary that they will discuss with their classmates (typically on alternating Wednesdays). Additionally, students will select research papers of their own interest and prepare brief summaries on those papers as well.

Team project: During the second half of the course student teams (2-3 students per team) will perform a research project related to deployable and reconfigurable structures. Students may either propose their own research topic or can choose from a range of potential projects proposed by the instructor. Teams will first prepare a project proposal for discussion and approval by the instructor. At the end of the semester, each team will submit a group report in a scientific format. Students are expected to identify a research and/or design problem in the field, perform an in depth analysis, explore the system behavior, and draw conclusions from the findings. The teams will also make a 15-20 minute presentation on their project, to be presented in front of the remainder of the class, and an audience of external judges.

Gradescope: Contributions of each individual in the team have to be specified in both the report and the presentation.

Gradescope: We will be using Gradescope to manage homework, reading reviews, and exam grading this term. Gradescope allows us to provide fast and accurate feedback on your work, and allows you to keep a digital easily accessible version of all your work. Homework can be scanned using a smartphone, a regular scanner, or can be written using an I-Pad. PDF files (e.g. of your source codes and plots can be directly submitted). Homework and exam grades will be returned through Gradescope only. As soon as grades are posted, you will be notified so that you can log in and see your feedback. You may also submit regrade requests if you feel we have made a mistake. Your Gradescope login is your university email and you can set up an account (if you do not have one yet).

Midterm Exam: There will be one midterm exam that covers the course topics (Exact Date TBD), and there will be no final exam with the course.

Canvas: The canvas site will be used to post homework assignments, grades, and other materials.

Getting help: I encourage you to take advantage of my office hours. However, I am also happy to talk to you by appointment, or any time my office door is open, and I am not otherwise engaged.

Ethics: You are expected to adhere to the UM Engineering honor code and rules of conduct in all your activities pertaining to this class. I will expect that you have read and understand the honor code: http://www.engin.umich.edu/college/academics/bulletin/rules .