Instructor:

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Office Hours:

Open office hours: By availability and/or by appointment

Text:

(2) Supplementary Handouts, additional material provided to facilitate course teaching
(3) Representative References, for design and analysis of rigid-body mechanisms, e.g.,  

Prerequisites:

Vector and matrix analysis; planar kinematic analysis of mechanisms; strength of materials; linear deformation and stresses in beams; and ability to handle computer project assignments.

Grading:

- Homework: Weekly or biweekly assignments (40%)
- Group Projects: Two minor and one major projects (30%)
- Exams: In-class or take-home midterm exam (15%)  
    In-class or take-home final exam (15%)

The exam format and dates will be determined in advance, in concurrence with students enrolled in the class. Computer usage will be emphasized in home assignments and projects in the course.
Course Objective:

Compliant mechanism design is a relatively new field of study. Recent developments, based on existing theories in rigid-body kinematics and deformation of beam-like segments and structures, have made it possible to design compliant mechanisms. These mechanisms, which derive some or all of their mobility from deflection of compliant members rather than from rigid-body pairs only, often possess one or more of the following attributes: reduced cost, weight, lubrication, lash, shock and noise; and improved ergonomics, assembly, and manufacturability, etc.

Topics in rigid-body kinematic analysis and synthesis, and linear elastic beam deflections will be reviewed, and modeling and analysis of large-deflection beams will be introduced. Compliant mechanism design and analysis methods will be introduced with applications. A significant group project, emphasizing problem definition, design conceptualization, modeling, optimization, and prototyping, will be an important part of this course.

Brief Course Description:

Introduction to compliant mechanisms; review of rigid-body mechanism analysis and synthesis methods; synthesis of planar mechanisms with force/energy constraints; pseudo-rigid-body models; force-deflection relationships; compliant mechanism synthesis methods; and special topics, e.g. bistable mechanisms, constant-force mechanisms, parallel mechanisms, and chain algorithm in design. Emphasis will be on applying the assimilated knowledge through a major group project on compliant mechanism design.

Nature of Design Content:

The course reviews and introduces the necessary engineering science background in planar kinematic analysis of mechanisms and linear beam theory, with the purpose of modeling compliant mechanisms and introducing methods for their synthesis. Several design related problems are introduced as part of homework, project and exam. A major project requires each team of students to apply the methods learned to design and build a significant compliant mechanism.

Given below are estimates for the engineering science and design contents of the course:

- Engineering Science: 1.5 credits or 50%
- Engineering Design: 1.5 credits or 50%