GE 598 (GK): Compliant Mechanism Design

TTh 2-3.20 pm
1057 Lincoln Hall,
Office Hours: TBD

Instructor: Dr. Girish Krishnan
314 Transportation Building
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Description:
Classification into lumped and distributed compliance; Pseudo-Rigid Body Models (PRBM) for analysis with emphasis on design synthesis; Variational formulations and nonlinear programming techniques for optimum topology and shape-size problems; Building block methods including constraint based design for synthesis using first principles; Examples of compliance in nature and engineering.

Reference Material:

Topics Covered:
- Introduction to compliance in nature and in the history of human engineered artifacts
- Classification of design problems in compliant mechanisms
- Analysis and synthesis using conventional rigid-link kinematics
- Automated computational synthesis using nonlinear programming and computer-aided analysis
- User-insightful first principles based techniques

Software:
- Matlab, and any finite element software

Grading:
- Three major homework assignments: 10% each.
- One final project: 60%
  - Project will involve design of a compliant mechanism for an application. 5% will be assigned for problem description, 10% for systematic design process, 10% for software validation, 20% for prototyping, 10% for project documentation that will be evaluated through the quality of the final report, and 5% for final project presentation.
- One advanced topics presentation: 10%
  - Choose any topic such as healthcare, energy, robotics, aviation or product design and the relevance of compliance in the field.
August 27, 2013: Introduction, course overview, feedback


September 3, 2013: Review of Rigid Body Kinematics, analysis and synthesis of planar linkages

September 5, 2013: PRBM: derivation

September 10, 2013: PRBM

September 12, 2013: PRBM examples

September 17, 2013: Distributed Compliance

September 19, 2013: Optimization techniques through distributed compliance (Turn in HW 1)

September 24, 2013: Topology Optimization

September 26, 2013: Topology Optimization

October 1, 2013: Topology Optimization

October 3, 2013: Guest Lecturing (Turn in HW 2)

October 8, 2013: Introduction to Constraint based design

October 10, 2013: Beam constraint model

October 15, 2013: Building Block Method

October 17, 2013: Building Block Method- instant center and spring mass model

October 22, 2013: Load flow based analysis and synthesis

October 24, 2013: Shape morphing mechanisms

October 29, 2013: FACT 3D mechanisms

October 31, 2013: Selection of Compliant Mechanisms

November 5, 2013: Summary of Synthesis Methodologies

November 7, 2013: Review of a research paper, Project discussion

November 12, 2013, Review of a research paper, Project discussion

November 14, 2013: Student Presentation

November 19, 2013: Student Presentation