MECH 460/515B   Advanced Mechanics of Materials

Winter Term, T1

Contact Information

Professor: Dr. Mattia Bacca
Mechanical Engineering
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Office Hours: *Send an email to schedule*

Class Format

Lectures: Tue/Thu   11 - 12.30   West Mall Swing Space 409

Course description

Theory of beams, membranes, plates and shells. Selected problems in linear elasticity. Nonlinear elasticity and viscoelasticity for rubbers, soft tissue and gels. Plasticity and damage.

The course is aimed for senior undergraduate and junior graduate students. The scope is (1) to explore advanced applications of Hooke's law in mono-dimensional and bi-dimensional structures; (2) to provide use of advanced constitutive models to better describe the mechanical behavior of materials.

Pre-requisites

MECH 360

Learning objectives

1. The student must prove her/his ability to solve some simple problems related to beams, membranes, plates and shells.
2. The student must prove her/his ability to use advanced constitutive models for materials based on nonlinear elasticity, viscoelasticity, plasticity and damage.

Course Grading Scheme

Essay: 20%

Midterm exam: 30% (Closed book)
Final exam: 50% (Closed book)

A proper formula sheet will be provided during the examination.

Textbook

No mandatory books;

Suggested books:

A.P. Boresi, R.J. Schmidt, O.M. Sidebottom "Advanced mechanics of materials", *Wiley*.

A. Bowers "Applied mechanics of solids", *CRC Press*.

D. Roylance "Mechanics of Materials", *Wiley*.

S.P. Timoshenko, S. Woinowsky-Krieger (2010) "Theory of Plates and Shells (2nd edition)", *Mc Graw Hill*.

Further reading:

V.A. Lubarda "Elastoplasticity Theory", *CRC Press*.

R.W. Ogden (1984) "Non-linear elastic deformations", *Dover*.

G.A. Holzapfel (2000) "Nonlinear Solid Mechanics: A Continuum Approach for Engineering", *Wiley*.

Course schedule

Week	Topic
1	Theory of beams;
2	Theory of membranes and plates;
3-4	Theory of shells;
5	Selected problems in linear elasticity;
6-8	Nonlinear elasticity;
9-10	Viscoelasticity of rubbers and gels;
11-12	Plasticity;
13-14	Damage;

The syllabus might be updated during the course