

5M Elasticity

Course Aims

1. To introduce advanced topics in the nonlinear elasticity.
2. To introduce constitutive laws for anisotropic material.
3. To formulate and solve some boundary-value problems.
4. To demonstrate applications of nonlinear elasticity to artery tissue mechanics and other current areas of research.

Course Outline:

1. Revision of the essentials of continuum mechanics.
2. Material symmetry. Stress- deformation relations for an isotropic material.
3. Internal constraints, including incompressibility.
4. Formulation of boundary-value problems in general, and simple examples of boundary-value problems.
5. Anisotropic elastic materials, including fibre-reinforced materials.
6. Applications to arterial tissue.
7. Solution of boundary-value problems involving non-homogeneous deformations.

Essential Prerequisite:

4H Continuum Mechanics and Elasticity

Recommended Reading:

Nonlinear Solid Mechanics, G.A. Holzapfel: Wiley (2001)

Lectures notes Nonlinear Elasticity with Applications to Material Modelling, R.W.Ogden, Warsaw 2003 (pdf copy available)

Non-Linear Elastic Deformations, R.W. Ogden: Dover (1997)

ILOs

On completion of this course the student will be expected to know and understand the main aspects of the theory and should be able to

1. understand and apply the general principles relating to constitutive laws;
2. formulate boundary-value problems using stress tensors and constitutive laws;
3. solve a number of illustrative boundary-value problems;
4. understand the constitutive modelling of anisotropic material
5. learn advanced applications of nonlinear elasticity to artery tissues

Resources Required:

Printed lecture notes are available for most parts of this course. The rest of the course material is available in accessible review articles.

Method of Delivery:

This is intended to be a self-study (reading) course supplemented by a few lectures to explain key concepts and more difficult material, and regular tutorials.