Continuum Mechanics: Solids

MATH 6760 001
T, TH 2:00 pm - 3:30 pm, JWB 308
Three credit hours

Instructor:
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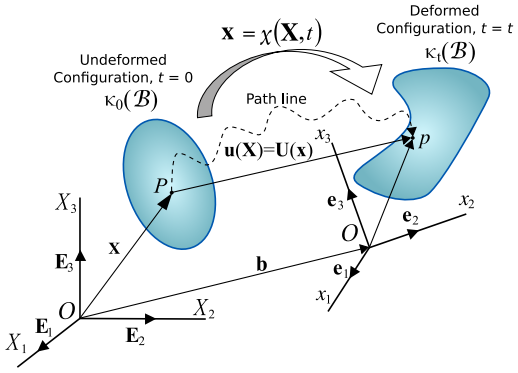
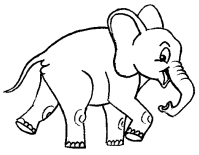


Continuum Mechanics provides a language for describing large and small deformations of solids under the action of forces, temperature changes, phase changes, and other external or internal factors, studies law of thermodynamics, material instabilities, etc. To describe these phenomena, the techniques from tensor algebra, variational methods and math modeling are used. In the words of Lagrange: "*The admirers of the Analysis will be pleased to learn that Mechanics became one of its new branches*" *(Mécanique analytique).*

The course covers: *Vectors and Tensors, Kinematics of Deformation, Conservation and Balance Laws, Thermodynamics, Constitutive Relations, Energy Principles, and Introduction to Optimal Design.*

The unifying approach of the Continuum Mechanics encompasses elasticity, plasticity, viscosity, metamaterials, waves, etc. It is fundamental for civil and mechanical engineering, bioengineering, geology, materials science, and design of new materials.



Why a general approach is helpful? Several travelers found an elephant in a dark barn. Each touched the elephant and claimed that elephant is like rope, blanket, spear, wall, etc. until the Elephant Keeper opened the door of the barn, and everyone discerned the whole elephantness

The textbook "Continuum Mechanics and Thermodynamics" by *Tadmor, Miller, and Elliot* (2012) (Ch 1-7) is praised for its clarity and many examples. It will be complemented with several **research papers** and the **instructor's notes** which discuss recent progress in composites, optimal and exotic structures, material stability, lattices, etc.

Prerequisites are calculus, linear algebra, differential equations, and some familiarity with analysis. The class **is addressed** to graduate and qualified senior undergraduate students.

The **grade** is based on homeworks (mainly exersices from the book) and a research project.