Continuum Mechanics: Solids

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

Instructor:
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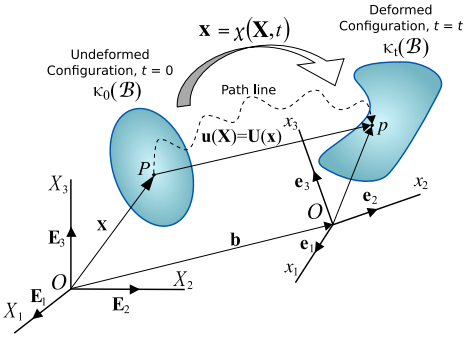
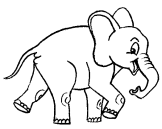


Solid mechanics is a branch of Continuum Mechanics, that provides a language for describing large and small deformations of solids under the action of forces, temperature changes, phase changes, and other external or internal agents. It studies various types of materials, thermodynamics, material instabilities, metamaterials, etc. To describe these phenomena, we will study and use techniques from tensor algebra, variational methods and math modeling. Solid mechanics is fundamental for civil and mechanical engineering, geology and materials science. It has specific applications in many other areas, such as understanding the anatomy of living beings, and the design of new materials.

The textbook "Continuum Mechanics and Thermodynamics" by *Tadmor, Miller, and Elliot* (2012) 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.

Why study continuous mechanics? Continuum mechanics provides natural applications to tensor analysis, geometric and variational methods, that inspired development of these fields. For those who value the beauty of mathematical theories, it is enough to cite Lagrange: "*The admirers of the Analysis will be pleased to learn that Mechanics became one of its new branches*" *(Mécanique analytique)*.

For more practically inclined people, we refer to the unifying approach of the Continuum Mechanics that encompasses elasticity, plasticity, viscocity, waves, etc., recalling the old parable: Several foreign travelers found an elephant in a dark barn. Each felt 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.



We will start *ab ovo*. **Prerequisites** are minimal: calculus, linear algebra, differential equations, and some familiarity with analysis. The class **is addressed** to graduate and qualified senior undergraduate students.