TAM 545 – ADVANCED CONTINUUM MECHANICS – Fall 2024

M,W | 1:00 PM - 02:50 PM | Urbana-Champaign Campus | 2058 LUMEB

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departmental webpage

This course is intended to introduce graduate students to a broad spectrum of theories of contemporary continuum mechanics and thermodynamics. First, using basic continuum mechanics as a stepping-stone, several more advanced theories (rational continuum mechanics, thermomechanics with internal variables, generalized continuum theories) are outlined from a broad perspective. These are then used to construct multifarious non-classical, multi- and/or coupled-field theories. The student may then go more in depth into any particular model. The primary focus of the course is on the construction of constitutive laws, with the leitmotif being that each continuum theory, and its various spin-offs, offers its own pros and cons. Some aspects of solution methods of initial-boundary value problems are also discussed. Mathematical concepts (e.g., elements of group theory, Legendre transforms, functionals) are introduced as needed.

Every advanced model/theory can be presented in terms of simple and self-explanatory examples. Our objective is to emphasize physical examples and applications to help students gain proper understanding of various phenomena so as to develop a panoramic view of continuum mechanics.

PREREQUISITES: TAM 445 or equivalent

GRADING: Homework and quizzes/tests (75%) and Project (25%). The project is to be decided in consultation with the instructor; student's ideas are welcome.

MAIN TEXT

O. Gonzalez & A.M. Stuart (2008), *A First Course in Continuum Mechanics*, Cambridge University Press.

REFERENCE BOOKS

A.C. Eringen (1999), *Microcontinuum Field Theories I, II*, Springer.

G.A. Maugin (1998), *The Thermomechanics of Nonlinear Irreversible Behaviours: An Introduction*, World Scientific.

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