Ph.D. Qualifying Exam: Continuum Mechanics

Department of Mechanical Engineering University of Utah

Exam Description:

This exam will cover concepts of continuum mechanics. The reference textbooks and course material that serve as a basis for this exam are taken from ME EN 6530 Continuum Mechanics. Students are expected to be able to:

- Perform vector and tensor manipulations in Cartesian coordinate systems
- Formulate and solve basic problems using the language and methods of continuum mechanics
- Describe motion, deformation, and forces in a continuum
- Derive equations of motion and conservation laws for a continuum
- Articulate basic principles and equations applicable to all constitutive models
- Set up and solve simple boundary value problems
- Articulate the applicability limits of continuum mechanics

Recommended References:

- Lai, Rubin, & Krempl, *Introduction to Continuum Mechanics*, 3rd Ed., ISBN 0750628944. [a digital version is provided via Canvas free of charge]
- J.N. Reddy, *An Introduction to Continuum Mechanics*, ISBN-13: 978-0521870443.
- http://www.continuummechanics.org/
- G.E. Mase, *Schaum's Outline of Continuum Mechanics*, ISBN-10: 07-040663-4.
- Essence of Linear Algebra (YouTube channel): https://www.youtube.com/playlist?list=PLZHQObOWTQDPD3MizzM2xVFitgF8hE_ab

Exam Materials:

An equation sheet will be provided with the exam. Students may bring a department issued calculator. No other materials will be allowed during the exam.

Topics:

Topics that will be covered by the exam include:

- Vector and tensor algebra
- Vector and tensor calculus
- Kinematics of continuum deformation
- Derivation of field equations using conservation laws for mass, momentum, and energy
- Constitutive equations
- Methods for solving linearized problems in elasticity