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:

Examinees will coordinate the creation of the equation sheet for the exam (One 8.5 x 11 inch page, can be two-sided, typed or hand-written). Students must provide this equation sheet to Graduate Advising for review no later than the Wednesday before the quals exam week. Once approved, the same 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