

H.L. Schreyer

ME 512: CONTINUUM MECHANICS
TR 2:00-3:15 ME 214

FALL/2014

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Office Hours: TR by appointment before or after class.

Course notes: Provided as PDF Files

Course Credit:	6 wk exam	20%
	12 wk exam	20%
	Final	40%
	HW	40%

Worst 20% expunged.

HW: One Assignment a week – given out on TH and due the following TH.
Your submission may be either paper or a PDF file. Handwritten quite OK. Material must be logically structured so I can follow what you are attempting to do – much more important than algebraic accuracy.

Exams: Closed book with heavy emphasis on definitions and short derivations. Old exams will be distributed.

CONTINUUM MECHANICS

Fall 2014 H.L. Schreyer

1. Course Objective:

The course is an introduction for engineers, physicists and applied mathematicians to the notations used in the field, to tensor calculus, to kinematics of deformation and to the basic principles that are common to all continuous media such as solid and fluid bodies. After taking this introductory material you will be in a position to read and enjoy most of the books listed as references.

2. Abstract:

Tensor calculus is the backbone for the course. Direct, indicial and matrix notations are introduced as convenient methods for representing tensors and components of tensors. Transformation relations, eigensystems and elementary tensor calculus complete this introductory phase.

The segment on kinematics of deformation includes reference and spatial gradient operators, rates of deformation, and a couple of measures of strain and their rates. The mappings that allow time derivatives to be taken inside a volume integral follow naturally. The background is then in place for developing any one of a number of strain tensors that exist in the literature.

Basic principles involving thermodynamics, momentum, moment of momentum and conservation of mass are introduced. The concepts of stress together with some of the various stress tensors arise naturally in this context.

Because of a lack of time, very little effort is spent on constitutive equations other than a discussion of objectivity. The more specialized courses of elasticity, plasticity and fluid mechanics are really applications of continuum mechanics with restrictions to particular constitutive assumptions.

3. Required Background:

Students at the senior or first year graduate level in engineering, mathematics and physics can handle the course if they are truly interested in the material. Normally students should have at least one, and preferably two, of the undergraduate courses on Mechanics of Materials, Vector Analysis and Linear Algebra

4. Course Text

There is no required text. I will be providing summary notes as we go along. This will cover the essential material and will closely follow the lectures.

A fairly complete, but old, set of notes will also be provided as a PDF file. The following table of contents for these notes provides a list of topics of which most, but not all, will be covered and some topics will be presented in a different order and with a different emphasis.

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TABLE OF CONTENTS

	Page
1. Tensor Calculus	1
1.1 Review of Matrices	1
1.2 Determinants and Matrix Inversion	4
1.3 Indicial Notation	8
1.4 Vectors	10
1.5 Vector Properties	12
1.6 Linear Transformations and Tensors	17
1.7 Tensor Properties	21
1.8 Transformation of Bases	25
1.9 Eigenvalues and Eigenvectors	30
1.10 Invariant Properties of Tensors	33
1.11 Mohr's Circle	37
1.12 Coordinate Systems	41
1.13 Gradient, Divergence, Curl and Related Operators	45
1.14 Gauss' Divergence Theorem	50
1.15 Stoke's and Other Integral Theorems	54
 2. Kinematics of a Continuous Medium	 63
2.1 Concept of a Continuous Medium	63
2.2 Referential and Spatial Gradients	67
2.3 Relations Between Volume Elements	71
2.4 Time Derivatives of Functions and Integrals	75
2.5 Rate of Deformation	78
2.6 Strains and Strain Rates	81
2.7 Physical Interpretation of Strains	85
2.8 Strain-displacement relations, infinitesimal strains and rotations	89
2.9 Rigid Body Motion	96
 3. General Principles of Continuum Mechanics	 101
3.1 Conservation of Mass	101
3.2 Reynold's Transport Theorem	104
3.3 Euler's First and Second Laws	106
3.4 Stress Principle of Euler and Cauchy	109
3.5 Cauchy's Fundamental Principle on Stress	111
3.6 Cauchy's First and Second Equations of Motion	115
3.7 Use of the Material Description	117
3.8 Boundary Conditions	120
3.9 First and Second Laws of Thermodynamics	123
3.10 Governing Equations Based on Infinitesimal Deformations	130
 4. Constitutive Equations	 131
4.1 Basic Objectivity Requirement	131
4.2 Elasticity	138
4.3 Fluids	144

References (In random order):

- R. Brannon All material by Professor Brannon – top notch.
Links to some of her work will be provided later.
- G.A. Holzapfel,
(Highly recommended) Nonlinear Solid Mechanics: A Continuum Approach
J. Wiley & Sons, Ltd., 2000
- L.E. Malvern Introduction to the Mechanics of a Continuous Medium,
Prentice-Hall, Inc., 1969
- R.M. Bowen Introduction to Continuum Mechanics for Engineers
Plenum Press, NY, 1989
- W.M. Lai, D. Rubin and E. Krempf Introduction to Continuum Mechanics
Pergamon Press Inc., 1978
- M.N.L. Narasimhan Principles of Continuum Mechanics
J. Wiley & Sons, Inc., NY, 1993
- G.E. Mase and G.T. Mase Continuum Mechanics for Engineers,
CRC Press, 1992
- Y.C. Fung Foundations of Solid mechanics,
Prentice-Hall, Inc., 1965
- Y.C. Fung A First Course in Continuum Mechanics
Prentice Hall, 1977
- T.J. Chung Continuum Mechanics
Prentice-Hall, Inc., 1988
- D.C. Leigh Nonlinear Continuum Mechanics,
McGraw Hill, 1968
- L.A. Segal Mathematics Applied to Continuum Mechanics
Dover, 1987 (Paperback)
- P.G. Hodge, Jr.,
Engineers Continuum Mechanics: An Introductory Text for
McGraw-Hill, 1970.
- D.S. Chandrasekharaiah
and L. Debnath Continuum Mechanics
Academic Press, 1994

Related Topics

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|----------------------------|---|
| H.F. Davis and A.D. Snider | Introduction to Vector Analysis
Allyn & Bacon, Inc., 1961, 4rth Ed.
(Good book - proof of Stoke's Th'm without coords.) |
| C. Truesdell | Essays in the History of Mechanics
Springer-Verlag, NY., Inc., 1968. |
| L. Brillouin | Tensors in Mechanics and Elasticity
Academic Press, 1964 |
| T.Y. Thomas | Concepts from Tensor Analysis and Differential Geometry
Academic Press, 1964 |
| H. Guggenheimer | Differential Geometry
McGraw Hill, 1963 |