MATH/GPHS 321, 322, 323 2013

Cartesian tensors and introduction to continuum mechanics

Module Outline

Lecturer: Prof. Euan Smith
CO517, ph. 4636422, email euan.smith@vuw.ac.nz

Course Objectives:
- To introduce the concept of Cartesian tensors
- To introduce some applications, especially in continuum mechanics – stress and strain, Euler's equation of motion, Navier's equation of motion, Navier-Stokes equation

Contact: Approx. 11 lectures plus 5 tutorials, which will be informal problem-solving sessions.

Lectures: Mon, Tues 1200-1250, Mar 5 to April 16, KK202

Tutorials Fri 1200-1250, Mar 8 to April 19, KK202

Assessment: Internal
- Four assignments counting 80% of the total, and an essay 20%.

Topics Intended to Cover

Fundamental principle of representation of physical quantities
Change of coordinate system
Introduction to Cartesian tensors
Tensor algebra and calculus
Applications:
- Concept of Stress - the stress tensor – symmetry of the stress tensor
- Real symmetric matrices - Principal Axes and Components
- Concept of Strain - strain tensor – rotation tensor
  - the strain ellipsoid
  - pure and simple shear
- Hooke's Law for isotropic materials
- Gauss's Law
- Euler's equation of motion
- Navier's equation for elastic materials
- Navier -Stokes equation for fluids

Reading:

Long, R.R. Mechanics of Solids and Fluids (Prentice Hall) QA 931 L849 M
Fung, Y.C. A First Course in Continuum Mechanics (Prentice Hall) QA 808.2 F981 F

Any book on the introduction to Cartesian Tensors (there are many in the Library QA807, 808, etc.)
Fun: Gordon, J.E. The new science of strong materials (or, why you don't fall through the floor) (Princeton Science Lib). Architecture Library. 3-day loan, TA403.2 G663 N 1974

Assignment due dates

Assignments will generally be due at the end of the week following the one in which they were set. Tutorial exercises will be given out with assignments. At tutorials time is available to ask questions about assignments.

Plagiarism. Any *unacknowledged* collaboration with another student is plagiarism. Plagiarised assignments will receive no marks. If you obtain help from another student with an assignment it must be acknowledged in the answers.
Copying another's answers is completely unacceptable.

MATH/GPHS 321,322, 323 2012 Differential Equations in Earth Science Module

MODULE STARTS Monday 29 April, after the mid-T1 break

Module Outline

Lecturer: Prof. Euan Smith
CO517, ph. 463 6422, email euan.smith@vuw.ac.nz

Course Objectives:

- To introduce three important partial differential equations of geophysics: the Laplace's equation, the wave equation, and the heat diffusion equation
- To give an example or two of how to solve each one in a practical situation
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Students are strongly recommended to do the 'Tensors' module before this one.

Contact: Approx. 11 lectures plus 6 tutorials, which will be informal problem-solving sessions.

Lectures: Mon, Tues 1200-1250, April 29 to May 28, KK202

Tutorials Fri 1200-1250, May 3 to May 31, KK202

Assessment: Internal

- Four two-weekly assignments counting 100% of the total.

Topics Intended to Cover

Laplace's equation – derivation and application to earth deformation
The wave equation – derivation and application to interface waves
The heat diffusion equation – derivation and application to the ocean cooling problem and diurnal and annual heating of the earth

Reading:

Long, R.R.	Mechanics of Solids and Fluids (Prentice Hall) QA 931 L849 M
Fung, Y.C.	A First Course in Continuum Mechanics (Prentice Hall) QA 808.2 F981 F
Turcotte and Schubert	Geodynamics – applications of continuum physics to geological problems
Stein, Seth and Michael Wysession	An Introduction to Seismology, Earthquakes and Earth Structure (Blackwell)

Assignment due dates

Assignments will be set every other week. Tutorial time is available to ask questions about assignments.

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