Cartesian tensors and introduction to continuum mechanics

Module Outline

Lecturer: Prof. Martha Savage
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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 14:10-15:00, Mar 5 to April 15, FT83/203 (Fairlie Terrace number 83 room 203) plus Wednesday 14:10-15:00, March 5.

Tutorials Fri 14:10-15:00, Mar 7 to April 18, FT83/203

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.