Review

In the previous lecture, we ...

- introduced fullerenes
- introduced Euler's Theorem for polyhedra

Aims

In this lecture, we will ...

- summarize the second half of the course
- provide details about the final exam

The Final Exam

When:	Wednesday, the 18th of June 2007
Where:	67.203
How long:	3 hours and 15 minutes
Starting time:	14:00
Finish time:	17:15
Value:	60% of final mark
What's in it:	Everything
How many Q's:	Four [5] "big" questions: 2 Tensors + 1 Continuum mechanics + 1 Anything
What can I bring:	One single-sided A4-sized summary sheet; calculator

6.6 Summary

In this lecture, I will *briefly* summarize what we have learnt about continuum mechanics and nanomechanics.

- Definition of strain and stress
- Material versus Spatial description
- Lagrangian versus Eulerian description
- The deformation gradient $F^i_j = \dfrac{\partial x^i}{\partial X^j}$
- Deformation of an arbitrary element
- Displacements $u^i = \bar{x}^i - x^i$
- Decomposing deformation into identity, strain and rotation matrices - valid only for *small* deformations

- Definitions of $\underset{\sim}{e}$ and $\underset{\sim}{\omega}$
- Lagrangian and Eulerian strain tensors
- Compressible and incompressible materials - dilatation
- Pure rotation and pure deformation - valid for any deformation
- $\mathbf{F} = \mathbf{RU} = \mathbf{VR}$
- $\mathbf{U} = (\mathbf{F}^T\mathbf{F})^{1/2}$ and $\mathbf{V} = (\mathbf{F}\mathbf{F}^T)^{1/2}$
- How to find the square root of a matrix - eigen decomposition: $\mathbf{A} = \mathbf{PDP}^{-1}$
- Compatibility equations: $\varepsilon_{pks}[\epsilon_{sj,ik} - \epsilon_{si,jk}] = 0$

- External force systems - body and contact forces
- Internal force systems - internal force vector = stress vector
- Components of stress
- Conservation of mass
- Conservation of linear momentum
- Conservation of angular momentum: $\sigma_{ij} = \sigma_{ji}$
- Principal directions and stresses
- The stress invariants I_1, I_2 and I_3
- Constitutive equations: Hooke's law for isotropic materials
  $\sigma_{ij} = \lambda\delta_{ij}\epsilon_{kk} + 2\mu\epsilon_{ij}$ or $\epsilon_{ij} = \frac{1+\nu}{E}\sigma_{ij} - \frac{\nu}{E}\sigma_{kk}\delta_{ij}$
- Admissible states of stress/strain

- Carbon nanotubes - (n, m)
- Armchair, zig-zag or chiral
- Metallic or semi-conductor: $n - m = 3i$?
- Circumference, diameter and chiral angle
- The buckyball: C_{60} fullerene
- Euler's theorem for polyhedra: $V - E + F = 2$
- Resulting shape of a pentagon, hexagon or heptagon?

Summary

In this lecture, we ...

- summarized the second half of the course
- provided details about the final exam

Homework Exercise 6.3:

1. Prepare your single-sided A4-sized summary sheet.
2. Study for the final exam!

End of MATH312!