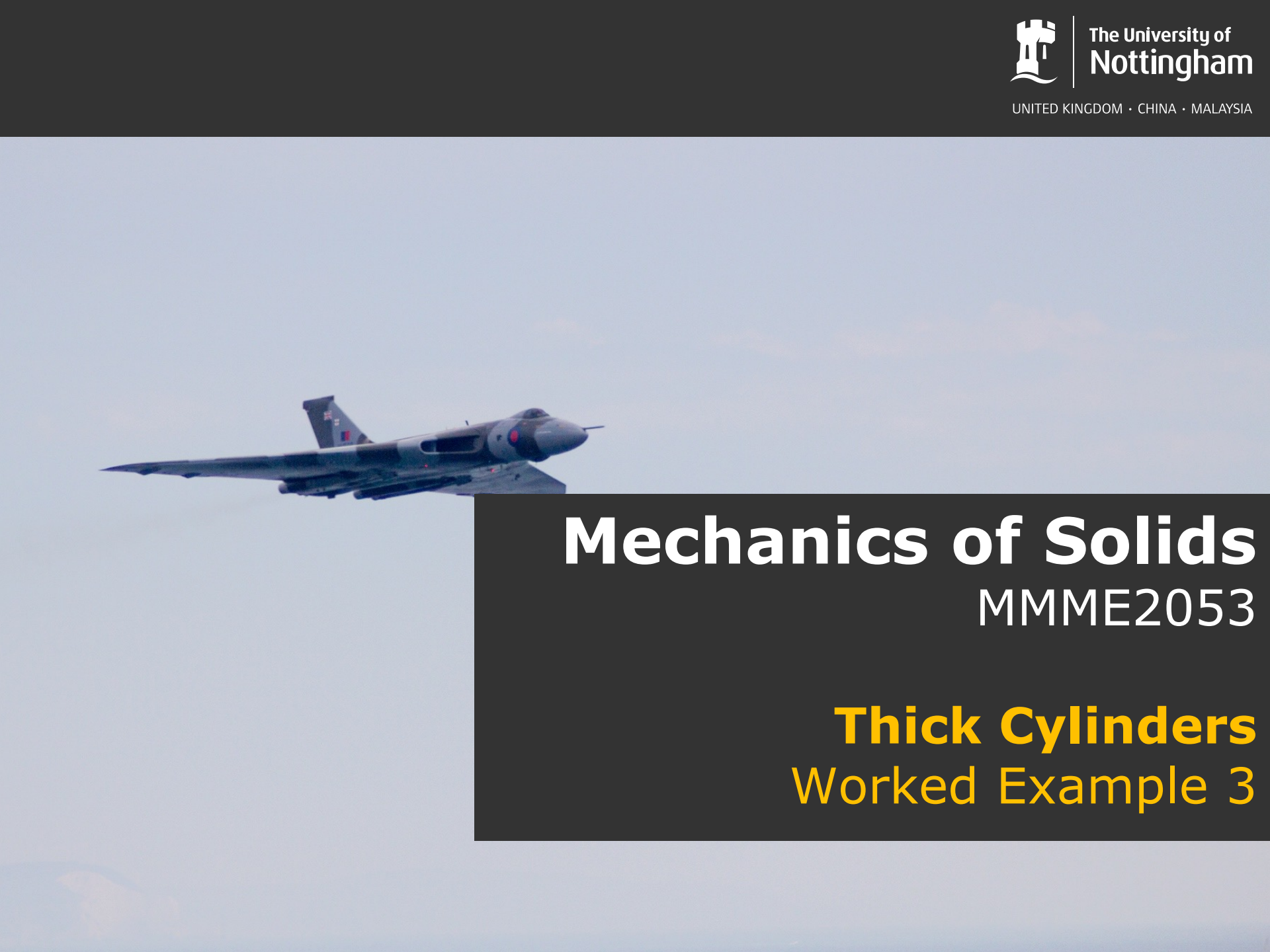

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Mechanics of Solids

MMME2053

Thick Cylinders

Worked Example 3

Analysis of Rotating Discs

- Rotating components such as flywheels and turbine discs can be regarded as **thick cylinders with body forces**, as well as possible pressure loads and as such represent an extension of the thick cylinder theory.

- Derivation is included in the notes

$$\sigma_r = A - \frac{B}{r^2} - \frac{\rho\omega^2(3+\nu)}{8}r^2$$

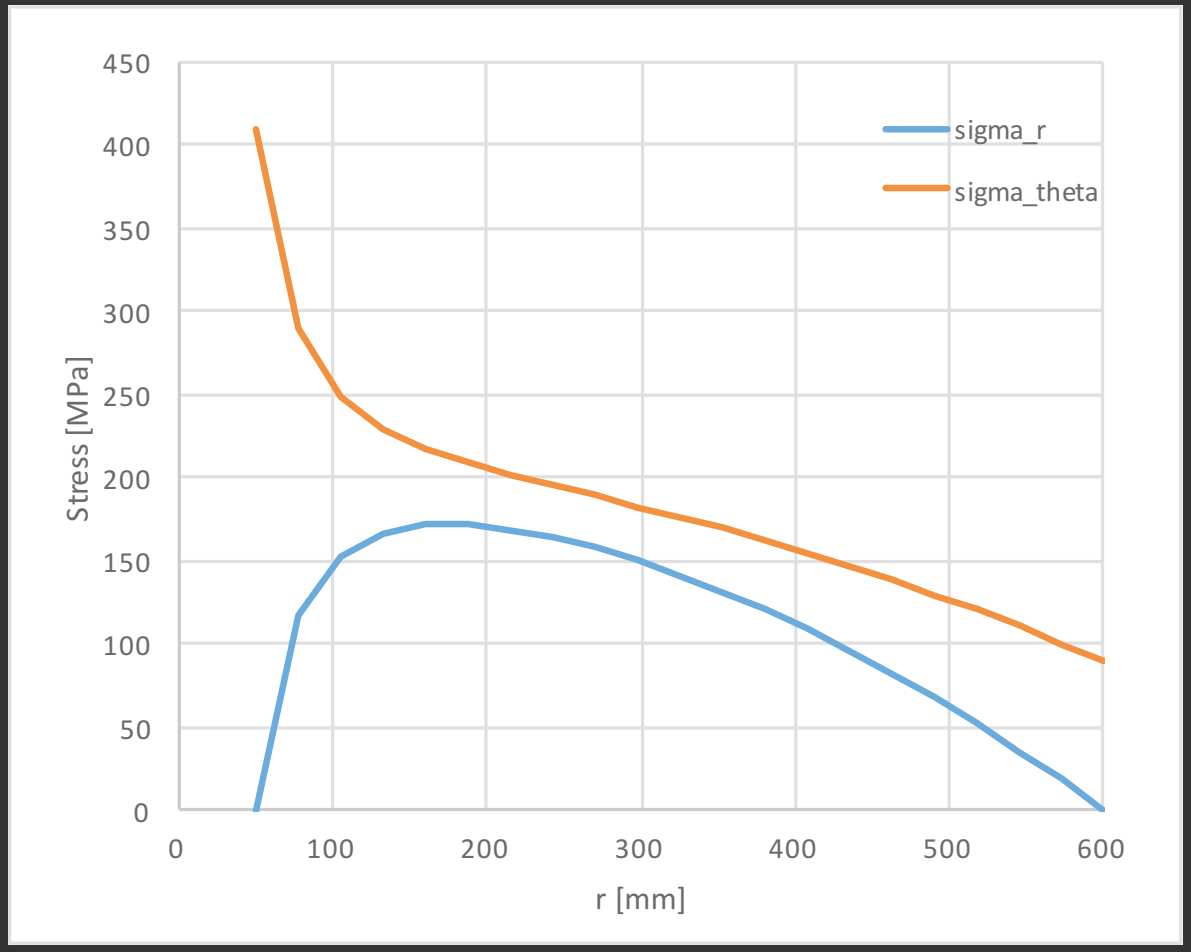
$$\sigma_\theta = A + \frac{B}{r^2} - \frac{\rho\omega^2(1+3\nu)}{8}r^2$$

Worked Example 3

- A turbine rotor disc with an angular velocity of 4000rpm has an external diameter of 1.2m and has a 0.1m diameter hole bored along its axis. Determine the stress distributions in the disc.

  $\rho = 7850\ \mathrm{kg/m^3}, \nu = 0.3$

Worked Example 3



Learning Objectives

1. Appreciate the difference between the stress analysis of thin and thick cylinders (knowledge);
2. Understand the derivation of Lame's equations (comprehension);
3. Determine the stresses in a thick walled cylinder subjected internal and external pressure (application);
4. Determine the stresses caused by shrink fitting a cylinder onto another (application);
5. Be able to include 'inertia' effects into the thick cylinder equations to calculate the stresses in a rotating disc (application).