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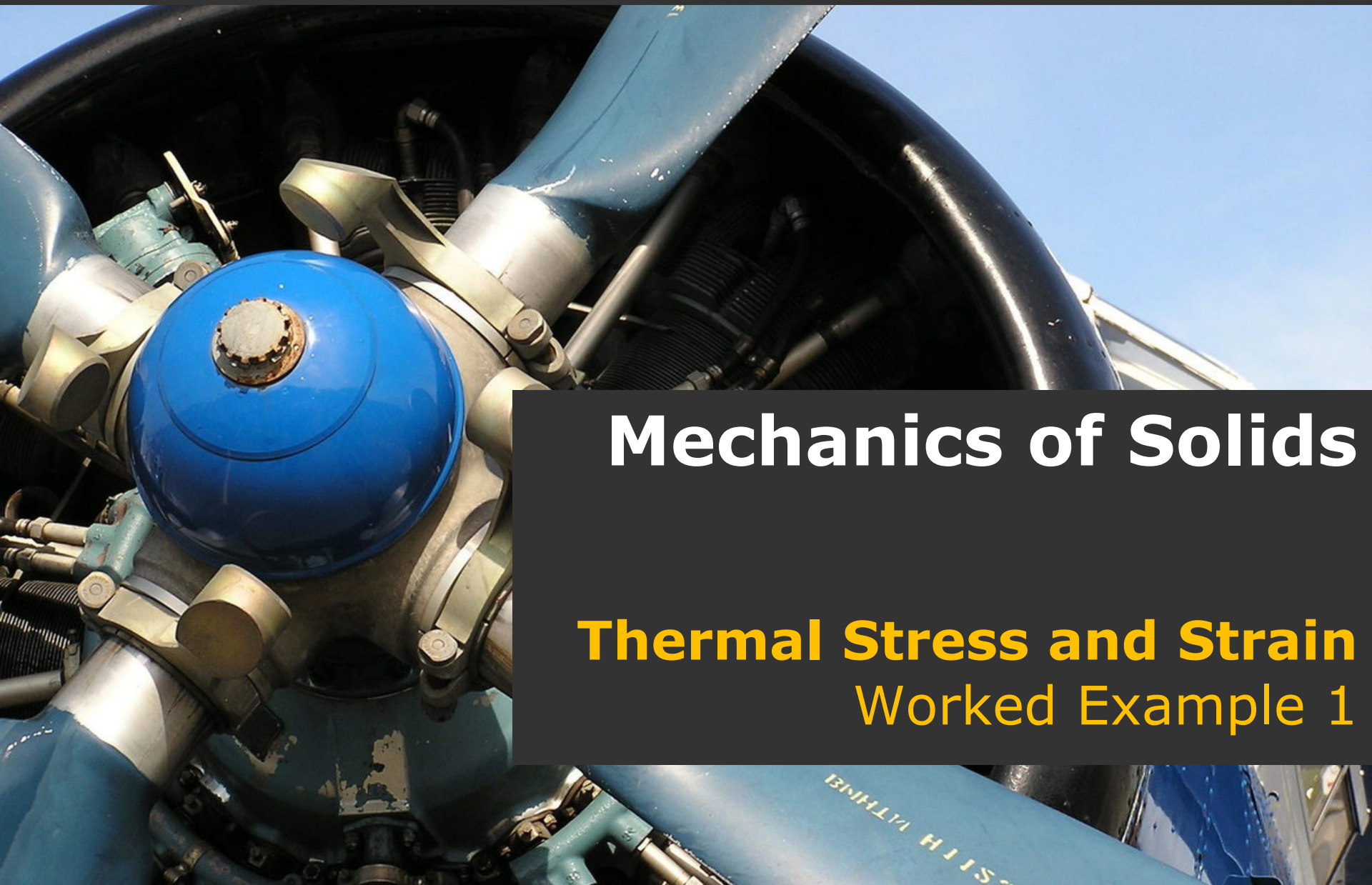


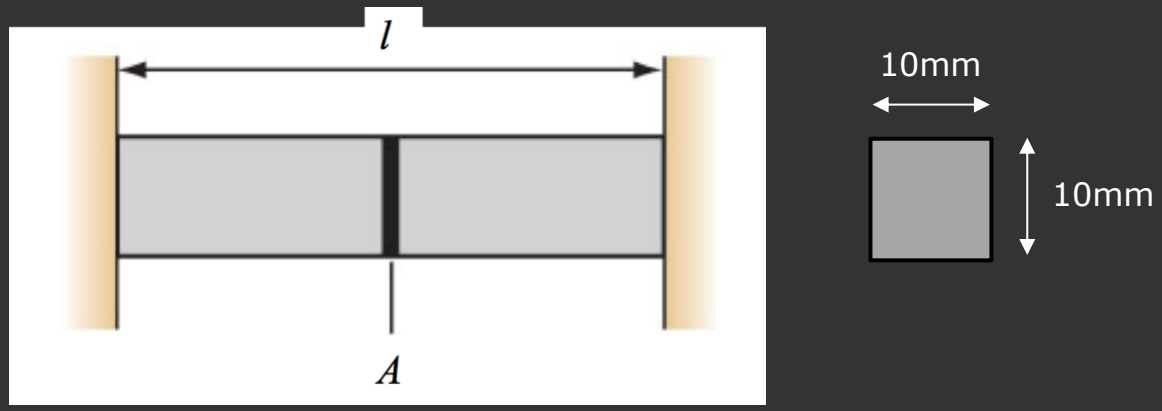
Mechanics of Solids

Thermal Stress and Strain

Worked Example 1

Worked Example

- The aluminium bar shown is increased in temperature from an initial value of 20°C to 40°C. Calculate the stress in the bar.



Assume α = 23 × 10^{-6} °C^{-1} and E = 70 GPa

Resistive Heating of a Bar

- Recalling:

$$\delta l_{total} = \frac{FL}{AE} + l\alpha\Delta T = 0$$

- Cancelling through l and rearranging for the reaction force, F, gives:

$$F = -AE\alpha\Delta T$$

- And we can determine the stress using:

$$\sigma = \frac{F}{A} = -E\alpha\Delta T$$

Resistive Heating of a Bar

- Inserting the values for this problem:

$$\sigma = \frac{F}{A} = -E\alpha\Delta T$$

$$= -70\times10^{9}\times23\times10^{-6}\times20$$

$$= -32.2\times10^{6}\ \text{Pa} = -32.2\ \text{MPa}$$