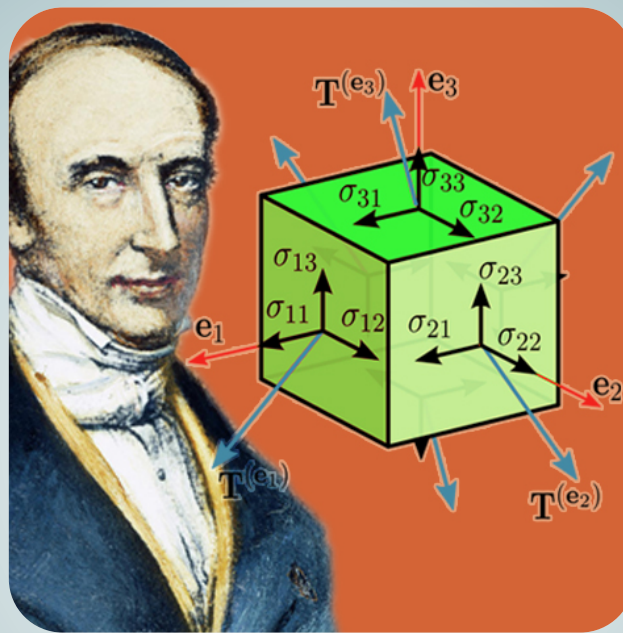


Mechanical Properties of Materials, Processing and Design

First exam continuous evaluation



Diego Ferreño Blanco
Borja Arroyo Martínez
José Antonio Casado del Prado

Department of Terrain and Materials Science and Engineering

This work is published under a license:

[Creative Commons BY-NC-SA 4.0](https://creativecommons.org/licenses/by-nc-sa/4.0/)



MECHANICAL PROPERTIES OF MATERIALS - CONTINUOUS EVALUATION - 1st TEST (10/02/2020)

1. A solid metal cube with an edge length $a=30$ cm is submerged in the sea at a depth of 600 m. Knowing the Young's modulus of the material, $E=210$ GPa, its Poisson's ratio, $\nu=0.3$, and the value of the sea water density, $\rho=1.06$ g/cm³, calculate the variation in volume of the cube. (10 points)

Formulas: $p = \rho g z$; $K = \frac{E}{3(1-2\nu)}$

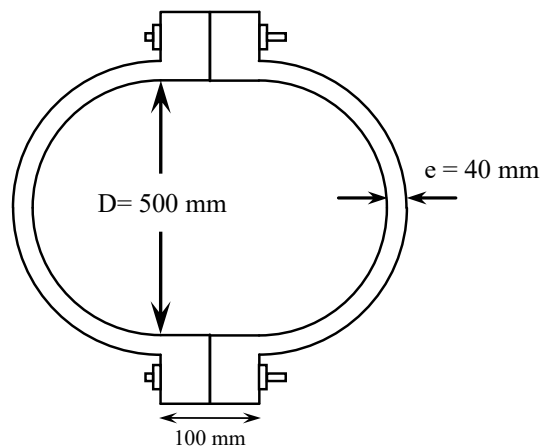
2. The figure attached represents the cross section of a pipe for conducting a pressurised fluid. As can be seen, it consists of a set of two symmetrical parts (which, for the purposes of calculation, may be assumed to be non-deformable) connected by two high strength bolts. To prestress the system, each screw was tightened $\frac{1}{4}$ turn after contact.

The characteristics of the screws are the following:

Thread pitch: $p = 0.6$ threads/mm

Diameter: $\Phi = 12$ mm

Material Young's modulus: $E = 200$ GPa



Taking this information into account, answer the following questions:

- a) Calculate the stress of the screws after prestressing (4 points)

- b) Obtain the pressure that causes the fluid to leak (4 points)

- c) How much is the stress of the screws at that moment? (2 points)