# Actividades Formativas IMEIO/ Educational Activities IMEIO

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| **Título/Title:** Elasticidad no lineal en los medios continuos/Nonlinear Elasticity within continuum mechanics | |
| **Organizador/Organizer:** [Jose Merodio jose.merodio@upm.es] | |
| **Profesores/Lecturers:** Jose Merodio | |
| **Horas totales/Number of hours: 4,5 créditos** | |
| **Lugar/Location:** ETSI Caminos, Canales y Puertos | |
| **Fechas/Dates: February-May, Tuesday 6:30-8:30 pm; Wednesday 7:30-8:30** | |

**Resumen/Summary:**

1.Kinematics

a. Bodies, configurations and motions The material time derivative Differentiation of Cartesian tensor fields Deformation and velocity gradients

b. Deformation of area and volume elements Some results from tensor algebra The square root theorem The polar decomposition theorem Analysis of deformation Stretch, extension, shear and strain Homogeneous deformations Analysis of motion

2 Balance laws and equations of motion

1.1. Mass Mass conservation Force, torque and momentum Body and surface forces Momentum and angular momentum Euler?s laws of motion The theory of stress Cauchy?s theorem Normal and shear stresses Energy Stress tensors

3 Constitutive equations

1.2. Elastic materials Objectivity Material symmetry Important example: isotropy Noll?s rule Isotropic functions of a second-order tensor Isotropic elasticity Hyperelastic materials

4 Stress-deformation relations for an isotropic material

1.3. Unconstrained materials Stress-deformation relations in terms of invariants The invariants I1, I2, I3 The invariants i1, i2, i3

5 Constrained elastic materials

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1.4. Incompressibility Stress-deformation relations Invariants I1,
I2 Invariants i1, i2 Other constraints Examples of strain-energy
functions Application to homogeneous deformations

6.Boundary-value problems

1.5. Extension and inflation of a thick-walled tube

7.Anisotropic elastic materials

1.6. Transverse isotropy Application to pure homogeneous deformation
Plane strain Two preferred directions Pure homogeneous strain Simple
shear Extension and inflation of a thick-walled tube

8. Residual stress

1.7. Response in the presence of residual stress. Invariants.
Extension, inflation and torsión of a tuve with residual stress.

9-Other boundary value problems

1.8. Shear-Azimuthal. Torsion. Hollow sphere under internal pressure.

**¿Aceptarías que el curso se pudiera emitir por videoconferencia restringido a algunos alumnos del doctorado que no pudieran asistir presencialmente? Would you accept that the course could be given by videoconference restricted to some doctoral students who could not attend in person? Sí/Yes**