

Tárgytematika / Course Description

Continuum Mechanics

NGD_MDAA55_1

Tárgyfelelős neve /

Teacher's name: dr. Pere Balázs

Félév / Semester: 2022/23/2

Beszámolási forma /

Assesment: Vizsga

Tárgy heti óraszám /

Teaching hours(week): 0/0/0

Tárgy féléves óraszám /

Teaching hours(sem.): 12/0/0

OKTATÁS CÉLJA / AIM OF THE COURSE

- Introduction to the theory of finite deformation of solids: kinematics, dynamics, material behaviour.

TANTÁRGY TARTALMA / DESCRIPTION

Topics:

1. Motion: reference and current configuration. Deformation gradient, polar decomposition of the deformation gradient. Multiplicative decomposition of the deformation gradient into volumetric and isochoric parts.
2. Infinitesimal material and spatial line elements, surface elements and volume elements. Strain tensors. Objective tensor fields. Velocity gradient, rate of deformation tensor, spin tensor. Rates of deformation tensors. Objective rates.
3. Balance principles: conservation of mass, momentum balance principles, balance of energy in continuum thermodynamics, entropy inequality principle. Concept of stress, Cauchy stress tensor, first and second Piola-Kirchhoff stress tensors. Helmholtz free-energy function, heat conduction equation.
4. Isotropic materials. Elastic, thermoelastic and viscoelastic materials. Hyperelastic materials. Neo-Hookean, Mooney-Rivlin, Ogden models. Incompressible and nearly incompressible materials. Relationship between the stress and strain. An example: rubber band.

SZÁMONKÉRÉSI ÉS ÉRTÉKELÉSI RENDSZERE / ASSESMENT'S METHOD

based on oral examination

KÖTELEZŐ IRODALOM / OBLIGATORY MATERIAL

Compulsory literature:

- Holzapfel, G. A.: Nonlinear solid mechanics (A continuum approach for engineering), John Wiley & Sons, Chichester, 2001
- Bonet, J., Wood, R. D.: Nonlinear continuum mechanics for finite element analysis, Cambridge University Press, 1997

Recommended literature:

- Haupt, P.: Continuum Mechanics and Theory of Materials, Springer-Verlag, 2000
- Batra, R. C.: Elements of continuum mechanics, American Institute of Aeronautics and Astronautics, 2006