# Tárgytematika / Course Description

## Continuum Mechanics

**NGD_MDAA55_1**

**Tárgyfelelős neve / Teacher's name:** dr. Pere Balázs

**Félév / Semester:** 2019/20/2

**Beszámolási forma / Assesment:** Vizsga

**Tárgy heti óraszáma / Teaching hours(week):** 0/0/0

**Tárgy féléves óraszáma / Teaching hours(sem.):** 0/0/0

### 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. Helmholz 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