SIMULATION OF THE BEHAVIOUR OF A KNITTED STRUCTURE MADE OF NI-TI WIRES TO THE MECHANICAL LOADING
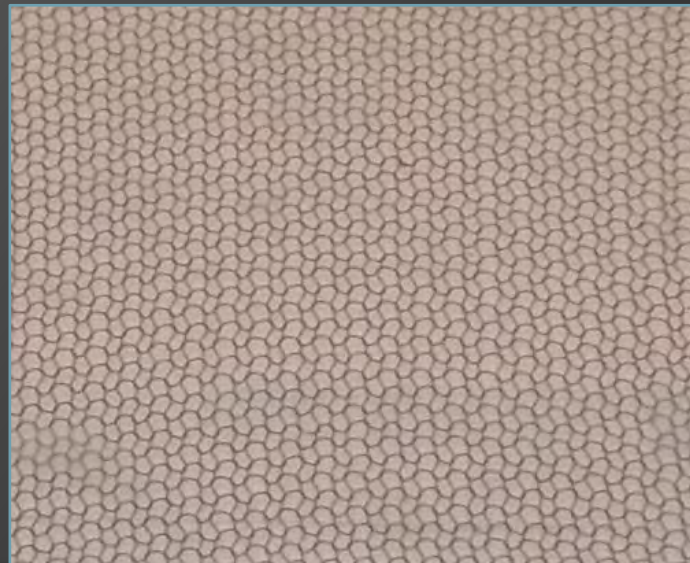
Jiří KAFKA

Technical University of Liberec

Department of Engineering Mechanics

Description of the work

- Two cases of the mechanical loading:
  - uniaxial tension,
  - bending by a punch.
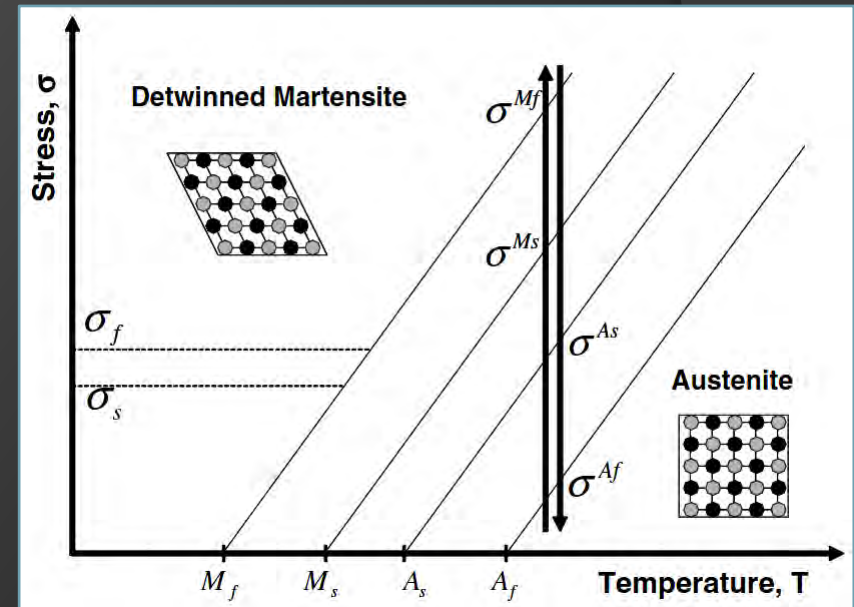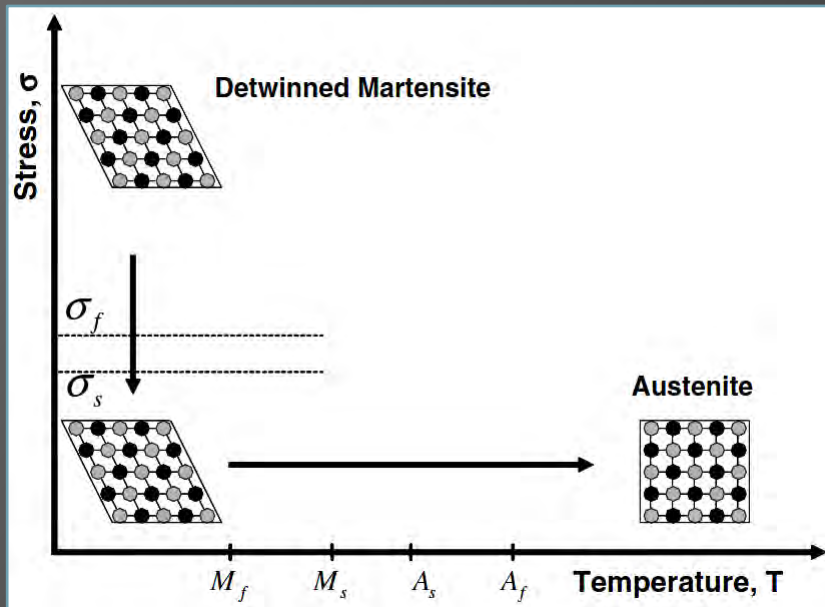- Knitted fabric from NiTi wires.

SMA – shape memory alloy

- NiTi belongs to the group of materials called shape memory alloy (SMA).
- SMAs have unique/special properties:
  - recovery of their shape, when the temperature is increased,
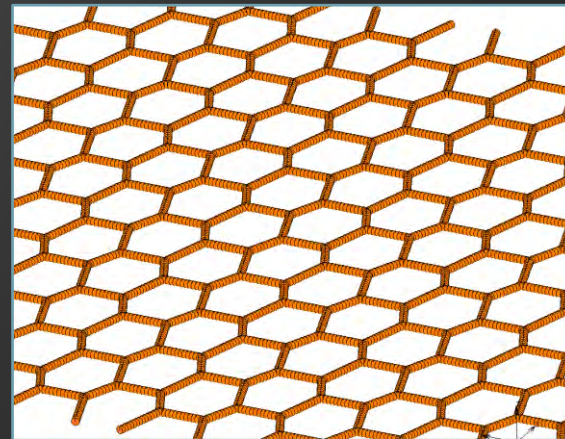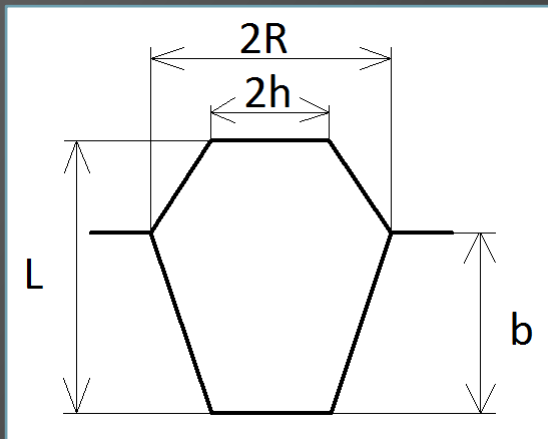 - recovery under high applied load,
  - …

SMA - phases

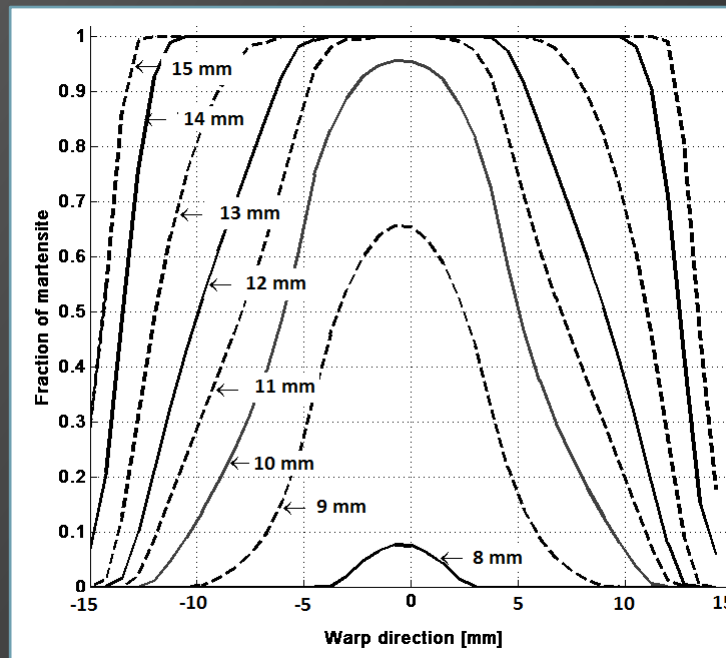- SMAs have two phases:
  - Austenite,
  - Martensite.

Geometry of both models

- The geometry is same for both simulations.
- The geometry is modeled as a plane model.
- The knitted fabric has a periodic structure.
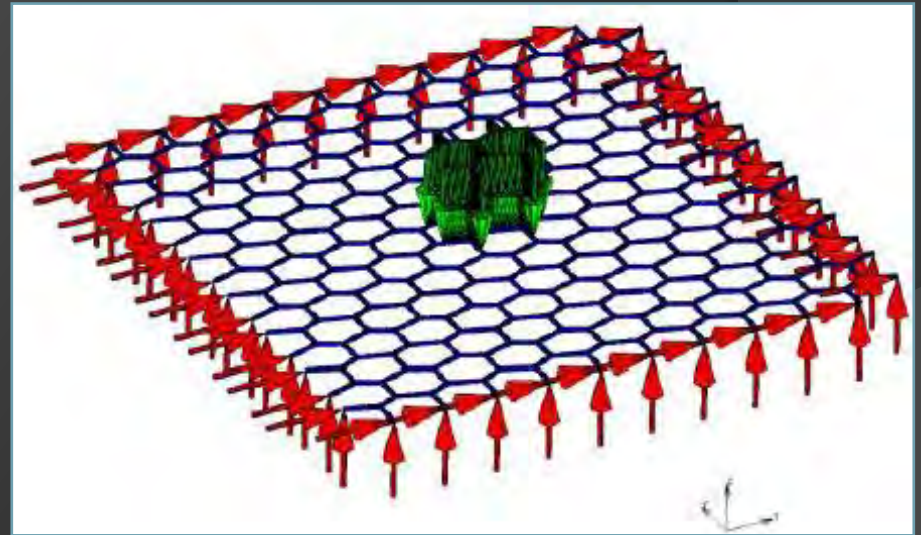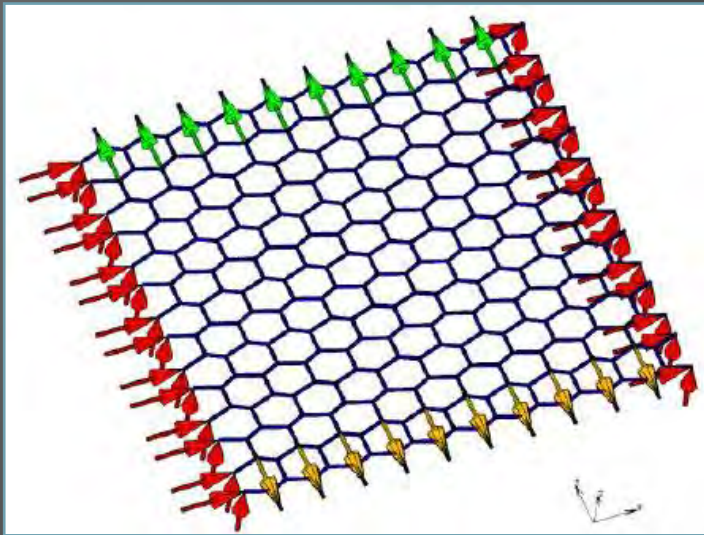
Model in COMSOL Multiphysics

· Material is defined as a linear isotropic material.

· Elements – beam ➡ linear geometry.

Model in COMSOL Multiphysics

- Boundary conditions:
  - first case – uniaxial tension,
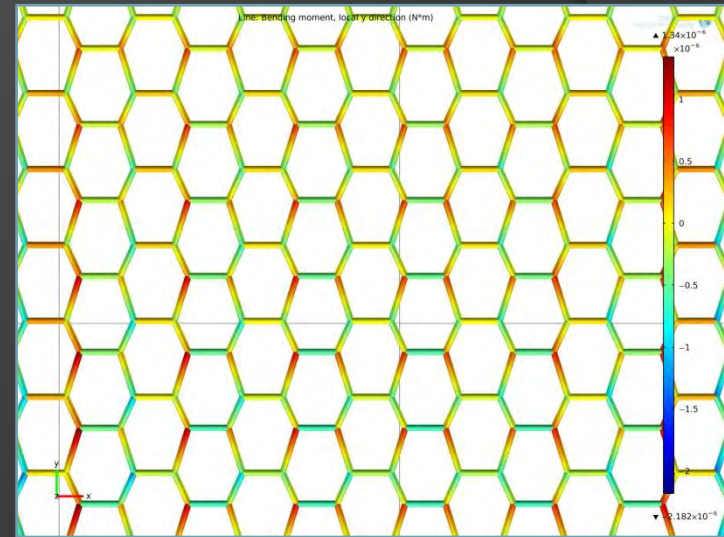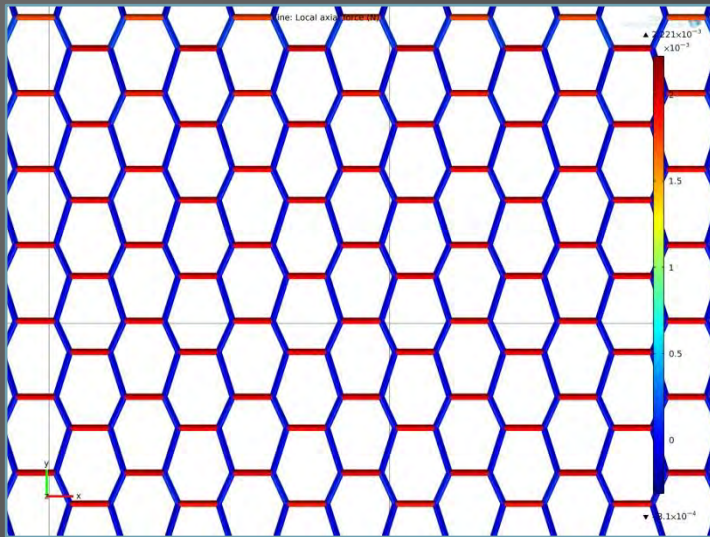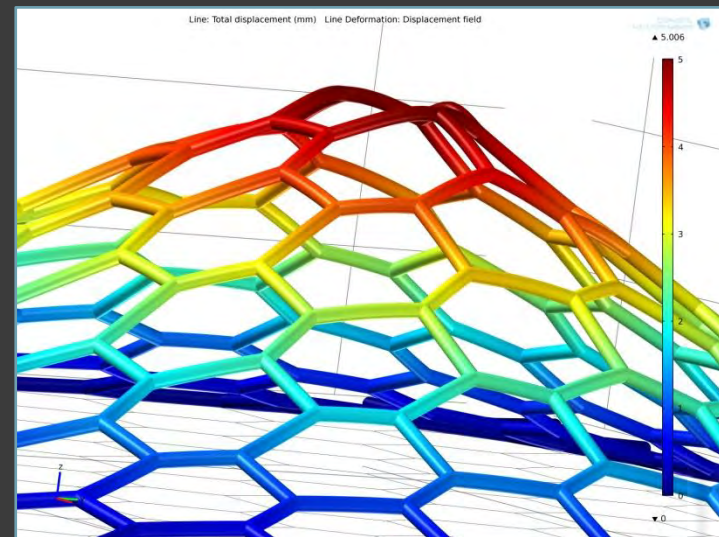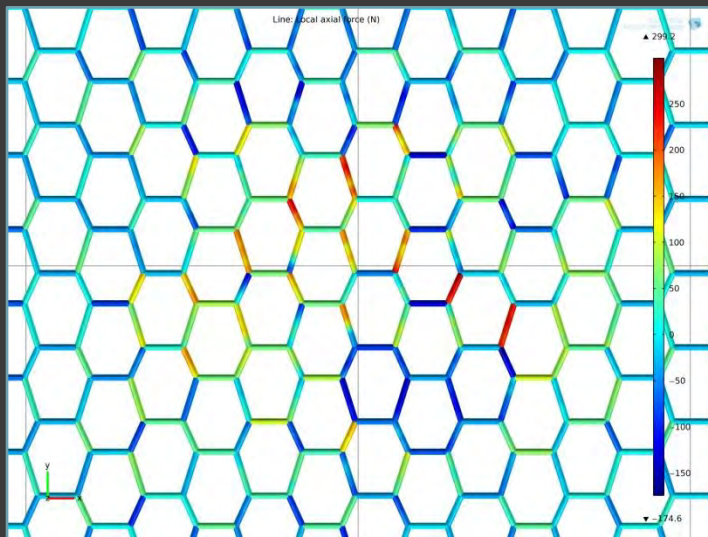 - second case – without contact.

Results

- We are still in austenite phase – we do not have to use material model for SMA.
- Beam elements can be used for these simulations.

The first case:

- no problems.

- The second case:
  - results are better for simulation with the contact.

Thank you for your attention!