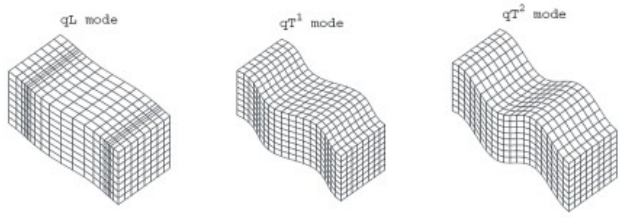
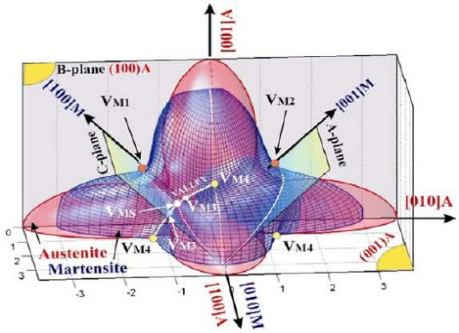
Laboratory of Ultrasonic Methods LUM

The LUM IT ASCR deals with both experimental and theoretical research in the field of mechanics of materials. This scope is divided between purely research activities (projects from national grant agencies and international research programs) and activities in close collaboration with Czech Technical University in Prague (including student leadership and teaching).

The recent topics solved at LUM include:

- Elastic wave propagation in anisotropic, non-linear and attenuating media, microstructured and phase-transforming materials close to the stability limits, thin layers and surface coatings, etc.





- In the past ca. 5 years, the resonant ultrasound spectroscopy became the most highly developed experimental technique used at LUM. This method was successfully applied on investigation of elastic properties of ferroelastics, rocks and minerals, thin layers, biomaterials and macroscopic composites. This method is based on inverse determination of the sought properties (elastic coefficients, damping) from resonant spectra of free vibrations of a specimen of the examined material. The obtained results are further used for characterization of processes undergoing inside the material, such as shear softening close to martensitic transitions, plastic flows, magneto-acoustic interaction, damage cumulation etc.
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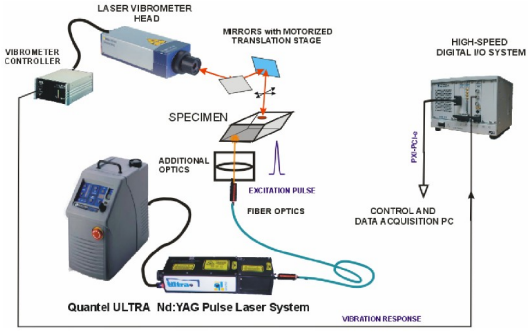
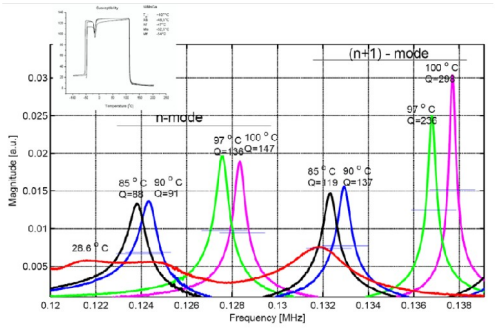
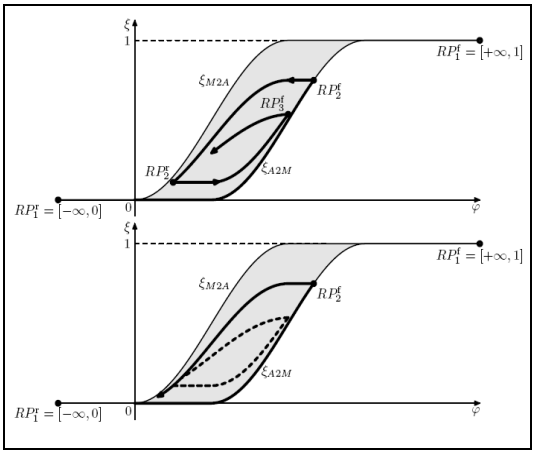
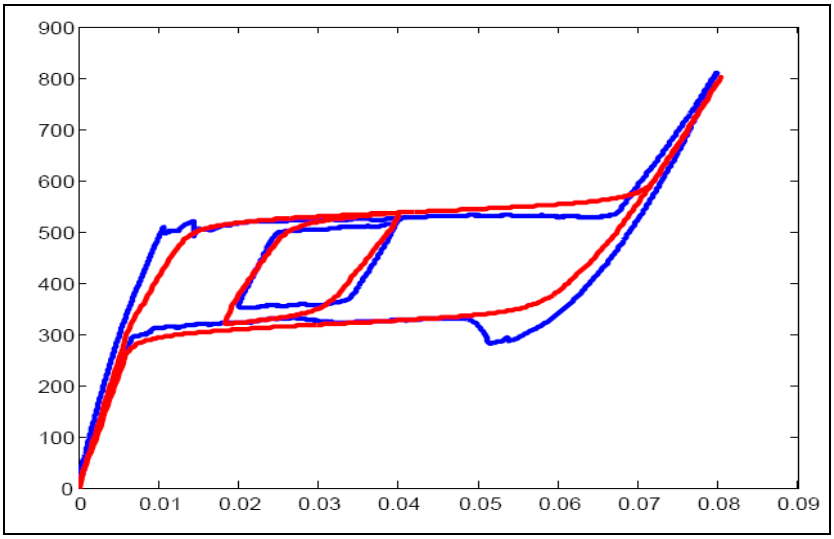




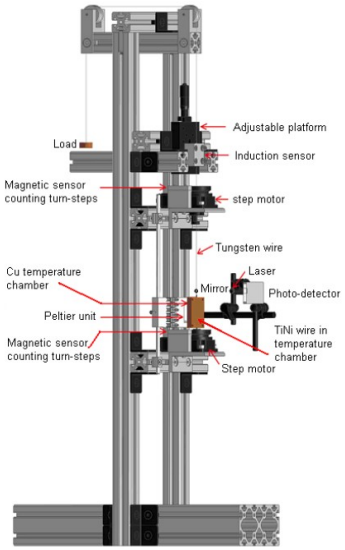
- Experimental observations and analysis of interfacial microstructures appearing in shape memory alloys during thermally driven transitions.. Both the kinetics and morphology of these objects are thoroughly studied, with the aim to get deeper understanding of the thermodynamic rules governing the transitions.
- Mathematical modelling of thermomechanical behavior of shape memory wires.

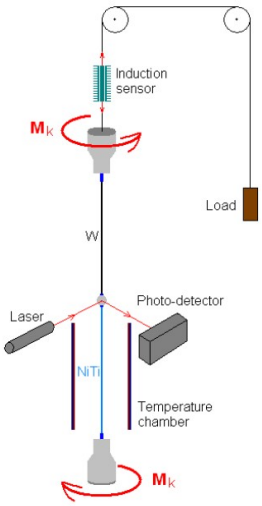


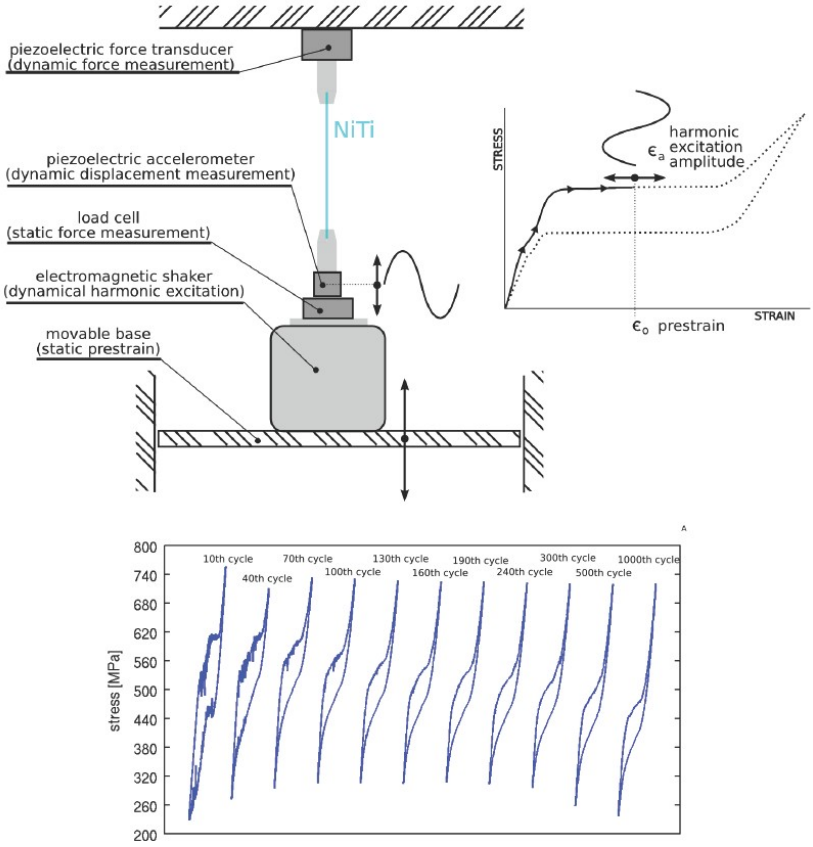


Stress strain curve for a NiTi wire. The blue curve shows the real, experimentally obtained behaviour, the red one the model developed at LUM.

- Quasistatic and dynamic testing of shape memory wires.







- Interaction of ultrasound with thin surface coatings (down to the nano-scale in the thickness of the coating). The surface coatings are examined either by ultrasound spectroscopy, or by propagation of elastic waves.

(Image by PolyTec)