The objective of the project is to investigate unstable behaviour of metallic materials using computational simulations based on a large strain thermo-visco-plasticity description. This phenomenon involves localized deformation modes, in which deformation is concentrated in narrow bands of the material while the rest of the considered specimen unloads. Such strain localization often leads to failure of the structural element.

In the project attention is focused on the numerical analysis of propagative instabilities, so-called Lueders bands and Portevin–Le Châtelier (PLC) effect, in rate-dependent plastic flow processes. Such specimen response is presented below in the pilot results of Lueders band simulations below.

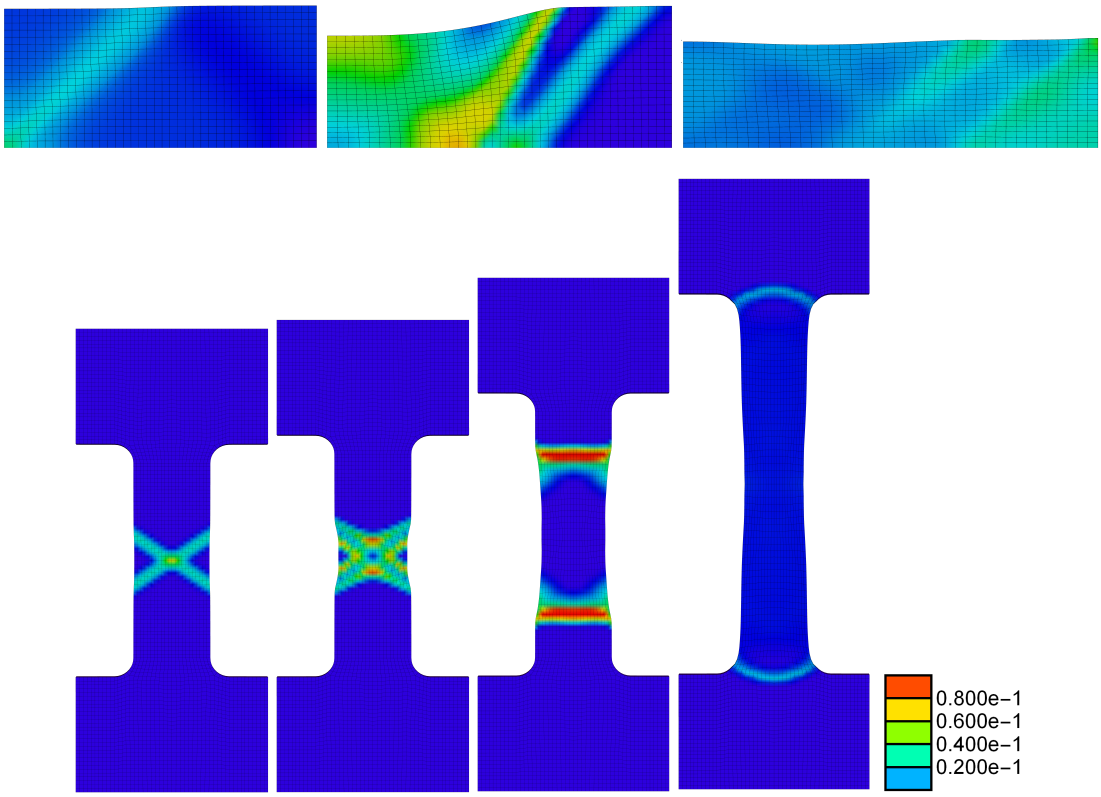

Figure 1: Deformed tensile specimen with distributions of incremental plastic strain measure in a sequence of loading steps, for two different geometries and parameter sets

The outcome of this research can have important implications for mechanical and civil engineering since the expansion of knowledge of instability phenomena, as well as the formulation of reliable numerical models of progressive failure of thermoplastic materials, will result in safer design of structures in extreme loading conditions (e.g. mechanical systems or civil engineering structures in high temperature and/or under dynamic loading).