The old Stefan problem in a new mechanical context

Prof. Dr. T. Roubíček
(Charles University Prague, Czech Republic)

The Stefan problem historically describes melting of ice or freezing (solidification) of water as a mere heat-transfer problem with a latent heat. This solid-liquid phase transition however naturally occurs in a mechanical context: melted liquid can flow while frozen solid exhibits some elasticity or some visco-elasticity and even may undergo some inelastic processes as fracture. This needs also to cope with the fluid-solid (so-called fluid-structure) interaction and calls for a model in Eulerian description. Thermomechanical consistency is pursued, as well as a mathematical analysis outlined. The concepts of semi-compressible fluids, viscoelastic solids in Jeffreys' rheology, phase-field fracture, and nonsimple materials (known also as multipolar fluids) will be employed. Some enhancements of this basic thermomechanical scenario will be mentioned, too.