Title:	Incompressible fluids with temperature dependent viscosity, numerical analysis and computational simulations
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Abstract: Flows of incompressible fluids connected with significant exchange of thermal and mechanical energy and with material moduli varying with the temperature and the shear rate, are described by the balance equations for linear momentum and energy, complemented by suitable constitution equations for the Cauchy stress and the heat flux. Assuming sufficient smoothness of quantities involved, the energy balance equation exhibits several equivalent formulations. However, within the context of weak solution, these formulations are, in general, not equivalent.
This thesis is based on the existence theory for the generalized Navier-Stokes-Fourier system describing planar flow of fluids with a shear and temperature dependent viscosity. We specify parameters of a generalized power-law model under which weak formulations of balance equations are meaningful and both considered formulations of the energy balance equation are equivalent. Supported by the existence theory, we propose and numerically solve several problems pursuing the aim to systematically compare the results for both energy balance formulations. We identify the parameters for which these two formulations lead to different computational results.

Keywords: Navier-Stokes-Fourier system, incompressible fluid, power-law fluid, temperature and shear dependent viscosity, Navier slip, balance of energy, weak solution, finite element method