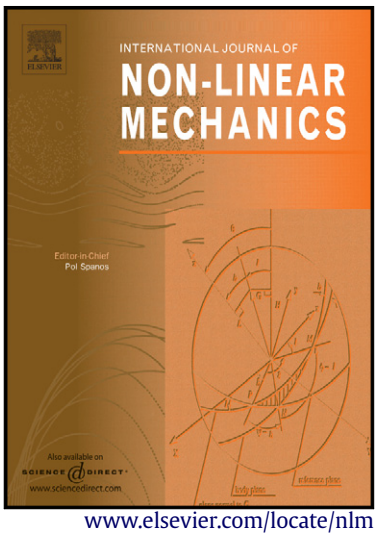

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Well-posedness of an instationnary non-Newtonian flows under conduction heat term with numerical applications

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Abstract

The current work deals with visco-plastic flows with thermal effects. The fluid motion is governed by the quasistatic Norton-Hoff operator coupled with the instationnary heat equation involving the conduction term. The fluid's viscosity is modeled by the exponential non linear Arrhenius law. The main novelties of this contribution are to establish the well-posedness of the coupled system using an adequate fixed point and to supply some numerical examples to illustrate the influence of the conductivity on the evolution of the flow.

Keywords: Visco-plastic fluid; Norton-Hoff model; Non-Newtonian flows; Arrhenius law; Conduction term; Fixed point; Freefem

1 Introduction

This work centers around a coupled system of non-linear differential equations linked to visco-plastic flows with thermal effects in the quasi-static case under a conduction term. The fluid's motion is governed by the incompressible Norton-Hoff model coupled with the time-dependent heat equation of which the dissipated mechanical power is the right hand side. The stand coupling resides in the fluid's viscosity modeled by the non-linear Arrhenius law, in the conduction term binding the flow's velocity and the interior heat flux, and in the source term of the heat system.

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