On the continuity in time of solutions to a generalized Navier-Stokes-Fourier system

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Abstract

We consider the flow of a generalized non-Newtonian incompressible heat-conducting fluid in a bounded domain $\Omega \subset \mathbb{R}^d$, $d = 2, 3$, subject to Dirichlet boundary conditions for velocity and temperature. The fluid obeys a power-law constitutive relation for the Cauchy stress with exponent p. For $p \geq (3d + 2)/(d + 2)$, we establish the existence of a global-in-time weak solution. We provide the proof of time continuity of the temperature in $L^1(\Omega)$. Furthermore, we investigate criteria for time continuity of the temperature component of a general weak solution. We prove time continuity for weak solutions of the entropy equation with a convective term and an L^1 right-hand side under minimal assumptions on the velocity regularity. We show that this continuity is equivalently described by vanishing dissipation on high level sets, a truncated variational inequality for admissible test functions, or the associated equality.

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