Colli, Pierluigi; **Grasselli, Maurizio**; **Ito, Akio**
On a parabolic-hyperbolic Penrose-Fife phase-field system. (English) Zbl 1011.35038
Electron. J. Differ. Equ. 2002, Paper No. 100, 30 p. (2002).

Summary: The initial and boundary value problem is studied for a non-conserved phase-field system derived from the Penrose-Fife model for the kinetics of phase transitions. Here the evolution of the order parameter is governed by a nonlinear hyperbolic equation which is characterized by the presence of an inertial term with small positive coefficient. This feature is a consequence of the assumption that the response of the phase variable to the generalized force which drives the system toward equilibrium states is not instantaneous but delayed. The resulting model consists of a nonlinear parabolic equation for the absolute temperature coupled with the hyperbolic equation for the phase. Existence of a weak solution is obtained as well as the convergence of any family of weak solutions of the parabolic-hyperbolic model to the weak solution of the standard Penrose-Fife phase-field model as the inertial coefficient goes to zero. In addition, continuous dependence estimates are proved for the parabolic-hyperbolic system as well as for the standard model.

MSC:

35D05 Existence of generalized solutions of PDE (MSC2000)
80A22 Stefan problems, phase changes, etc.
35G25 Initial value problems for nonlinear higher-order PDEs

Keywords:

initial boundary value problem; Penrose-Fife model; existence of solutions; nonlinear partial differential equations; continuous dependence on the data; inertial coefficient

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