Well-posedness results for phase field systems with memory effects in the order parameter dynamics

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Abstract

We study two models arising in phase transition dynamics. The state of the system is described by the pair (θ, χ), where θ is the (relative) temperature and χ is the order parameter or phase field. The main difference between the two models relies on whether global constraints on χ are imposed or not: accordingly, the resulting models will be called conserved or nonconserved. Memory effects influencing both the heat flux and the dynamics of χ have been considered in a number of recent papers. Here we assume the Fourier law for the heat flux in the energy balance equation, while we consider memory effects in the order parameter dynamics. We analyze well-posedness of corresponding Cauchy-Neumann problems for both conserved and nonconserved models. Various results are derived according to properties of the memory kernel involved.