# Solvability and asymptotic analysis of a generalization of the Caginalp phase field system

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We study a diffusion model of phase field type, which consists of a system of two partial differential equations involving as variables the thermal displacement, that is basically the time integration of temperature, and the order parameter. Our analysis covers the case of a non-smooth (maximal monotone) graph along with a smooth anti-monotone function in the phase equation. Thus, the system turns out a generalization of the well-known Caginalp phase field model for phase transitions when including a diffusive term for the thermal displacement in the balance equation. Systems of this kind have been extensively studied by Miranville and Quintanilla. We prove existence and uniqueness of a weak solution to the initial-boundary value problem, as well as various regularity results ensuring that the solution is strong and with bounded components. Then we investigate the asymptotic behaviour of the solutions as the coefficient of the diffusive term for the thermal displacement tends to 0 and prove convergence to the Caginalp phase field system as well as error estimates for the difference of the solutions.

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