HYPERBOLIC RELAXATION OF THE VISCOUS CAHN-HILLIARD EQUATION IN 3-D

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Abstract. We consider a modified version of the viscous Cahn-Hilliard equation governing the relative concentration u of one component of a binary system. This equation is characterized by the presence of the additional inertial term ωu_{tt} that accounts for the relaxation of the diffusion flux. Here $\omega \geq 0$ is an inertial parameter which is supposed to be dominated from above by the viscosity coefficient δ. Endowing the equation with suitable boundary conditions, we show that it generates a dissipative dynamical system acting on a certain phase-space depending on ω. This system is shown to possess a global attractor that is upper semicontinuous at $\omega = \delta = 0$. Then, we construct a family of exponential attractors $\mathcal{E}_{\omega,\delta}$, which is a robust perturbation of an exponential attractor of the Cahn-Hilliard equation, namely the symmetric Hausdorff distance between $\mathcal{E}_{\omega,\delta}$ and $\mathcal{E}_{0,0}$ goes to 0 as (ω, δ) goes to $(0, 0)$ in an explicitly controlled way. This is done by using a general theorem which requires the construction of another dynamical system, strictly related to the original one, but acting on a different phase-space depending on both ω and δ.

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