Mathematics > Analysis of PDEs

Finite dimensional reduction and convergence to equilibrium for incompressible Smectic-A liquid crystal flows

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We consider a hydrodynamic system that models the Smectic-A liquid crystal flow. The model consists of the Navier-Stokes equation for the fluid velocity coupled with a fourth-order equation for the layer variable \$\vp\$, endowed with periodic boundary conditions. We analyze the long-time behavior of the solutions within the theory of infinite-dimensional dissipative dynamical systems. We first prove that in 2D, the problem possesses a global attractor \$\mathcal{A}\$ in certain phase space. Then we establish the existence of an exponential attractor \$\mathcal{M}\$ which entails that the global attractor \$\mathcal{A}\$ has finite fractal dimension. Moreover, we show that each trajectory converges to a single equilibrium by means of a suitable Lojasiewicz--Simon inequality. Corresponding results in 3D are also discussed.

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