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Bifurcation and competitive evolution of network morphologies in the strong Functionalized Cahn-Hilliard equation.

The FCH is a higher-order free energy for blends of amphiphillic polymers and solvent which balances solvation energy of ionic groups against elastic energy of the underlying polymer backbone. Its gradient flows describe the formation of solvent network structures which are essential to ionic conduction in polymer membranes. The FCH possesses stable, coexisting network morphologies and we characterize their geometric evolution, bifurcation and competition through a center-stable manifold reduction which encompasses a broad class of coexisting network morphologies. The stability of the different networks is characterized by the meandering and pearling modes associated to the linearized system. For the H^{-1} gradient flow of the FCH energy, using functional analysis and asymptotic methods, we drive a sharp-interface geometric motion which couples the flow of co-dimension 1 and 2 network morphologies, through the far-field chemical potential. In particular, we derive expressions for the pearling and meandering eigenvalues for a class of far-from-self-intersection co-dimension 1 and 2 networks, and show that the linearization is uniformly elliptic off of the associated center stable space. (Received January 12, 2015)