

An Allen-Cahn Equation with Jump-Diffusion Noise for Biological Damage and Repair Processes

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ABSTRACT: We analyze a stochastic Allen–Cahn equation for the dynamics of biomolecular damage and repair. The system is driven by two distinct noise processes: a multiplicative cylindrical Wiener process, modeling continuous background stochastic fluctuations, and a jump-type noise, modeling the abrupt, localized damage induced by external shocks. The drift of the equation is singular and covers the typical logarithmic Flory-Huggins potential required in phase-separation dynamics. We prove well-posedness of the model in a strong probabilistic sense, and analyze its long-time behavior in terms of existence and uniqueness of invariant measures, ergodicity, and mixing properties.

The talk is based on a joint work with A. Di Primio, M. Fritz and L. Scarpa.