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Amplitude Equation for Instabilities Driven at Deformable Surfaces - Rosensweig Instability HARALD PLEINER, STEFAN BOHLIUS, MPI Polymer Research, Mainz, Germany, HELMUT R. BRAND, Theoretical Physics, University Bayreuth, Germany — The derivation of amplitude equations from basic hydro-, magneto-, or electrodynamic equations requires the knowledge of the set of adjoint linear eigenvectors. This poses a particular problem for the case of a free and deformable surface, where the adjoint boundary conditions are generally non-trivial. In addition, when the driving force acts on the system via the deformable surface, not only Fredholm's alternative in the bulk, but also the proper boundary conditions are required to get amplitude equations. This is explained and demonstrated for the normal field (or Rosensweig) instability in ferrofluids as well as in ferrogels. An important aspect of the problem is its intrinsic dynamic nature, although at the end the instability is stationary. The resulting amplitude equation contains cubic and quadratic nonlinearities as well as first and (in the gel case) second order time derivatives. Spatial variations of the amplitudes cannot be obtained by using simply Newell's method in the bulk.

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