Spatial Decay and Spectral Properties of Rotating Waves in Evolution Equations

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Abstract. Rotating waves are special solutions of reaction-diffusion systems which rotate at constant velocity while maintaining their shape. Nonlinear stability results for such waves are usually based on spatial behavior of the wave profile and on spectral properties of the linearization. In this talk we present suitable conditions guaranteeing that the rotating wave decays exponentially in space. We also derive an upper bound for the decay rate and extend our results to complex-valued cases. The proof utilizes resolvent estimates for perturbed Ornstein-Uhlenbeck operators, abstract semigroup theory, and sharp heat-kernel estimates. A key step is to solve the identification problem via a dissipativity condition which is equivalent to bounding the first antieigenvalue of the diffusion matrix. For the linearized operator we determine the essential spectrum and a specific part of the point spectrum including their associated eigenfunctions. Some extensions to second-order evolution equations will be briefly discussed. Finally, we present numerical results for spinning solitons that appear in the cubic-quintic complex Ginzburg-Landau equation.

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