STABILITY OF PLANAR FRONTS FOR A CLASS OF REACTION DIFFUSION SYSTEMS

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ABSTRACT

The purpose of this thesis is to study stability of one-dimensional traveling waves and multidimensional planar fronts as well as space-independent steady states for a class of reaction diffusion systems that arise in combustion theory and chemical reaction models. We begin by extending the recent one-dimensional stability results for reaction diffusion equations of this type. Using spaces with exponential weights, we shift the spectrum of the differential operator obtained by linearizing the equation about the front into the stable half-plane, and study the nonlinear equation on the intersection of the unweighted and weighted spaces. In this space, we prove the existence of a stable foliation in vicinity of the traveling front solution. The results provide a better understanding of the dynamics near the front, and improve the known stability theorems. We then turn to stability of the planar front solutions and their end states for a class of reaction diffusion equations in multidimensional space. We study the case when the spectrum of the linearization in the direction of the front touches the imaginary axis. Passing to the exponential weights, we obtain appropriate estimates for the nonlinear terms of the equation governing the evolution of the perturbations of the front in the intersection of the unweighted and weighted spaces. We then show that the unweighted norm of the solutions of the equation with small initial data remains bounded while the weighted norm algebraically decays for large times. Also, we prove stability of the end states of the front.