

## INTRODUCTION TO "CURRENT DIRECTIONS IN NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS"

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The papers collected here are among those presented at a conference on Nonlinear Partial Differential Equations in March, 1987, at Provo, Utah. They are representative of some of the more dominant current trends of research in partial differential equations. I would like to give my view of these trends, with special reference to the contributions in this volume.

### *1. Singular limits leading to interface problems.*

It is well known that for reaction-diffusion systems, the presence of a small parameter multiplying the highest order spatial derivatives in one or more of the equations may lead to the existence of solutions with internal layers. Layers in this context means that the spatial variation is much sharper in some localized regions of space than in others. These regions are typically small neighborhoods of surfaces which at least locally separate space into two parts.

Interest in internal layers of this sort is not only intrinsic to the mathematical phenomenon, but also derives from their being models for interfacial phenomena in practically all of the natural sciences.

In dynamical problems, layers appear as moving free boundaries; then the laws governing their motion and their stability or instability are highly important considerations. In stationary problems, dealing with singularly perturbed systems of second order elliptic or ordinary differential equations, one obtains a problem for a fixed free boundary in space. Issues here often center on the existence of solutions. In both cases, it is of interest to determine the fine structure of the interface; in fact that type of result may be crucial to the other task of unraveling the law of motion or of determining the interface condition.

Interfacial problems as singular limits of reaction-diffusion equations are well represented in these proceedings.

Caginalp and Chadam consider the stability of moving interfaces