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Section:

9. Ordinary Differential Equations and Dynamical Systems

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A free boundary problem for a reaction-diffusion equation

Certain phase-change processes, such as the one-dimensional Stephan problem, are described by the following free boundary value problem:

$$\begin{array}{ll} -(\mathbf{k}(\mathbf{x},\mathbf{y})\Psi(\mathbf{y}'))' & = \mathbf{f}(\mathbf{x},\mathbf{y},\mathbf{y}') \quad \mathbf{x} > \mathbf{s} \\ \mathbf{y}(\mathbf{s}) & = \mathbf{A} \\ \mathbf{y}(\mathbf{x}) & = \mathbf{B} \text{ for } \mathbf{x} = +\infty \\ \mathbf{k}(\mathbf{s},\mathbf{y}(\mathbf{s}))\Psi(\mathbf{y}'(\mathbf{s})) & = +\emptyset(\mathbf{s}) \end{array} .$$

where s is a priori unknown and has to be determined as part of the solution to the problem. Existence and uniqueness results are presented. This is based on a joint work with Y. Benkamra