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Sinopsis

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This book presents elementary models of transport in continuous media and a corresponding body of mathematical technique. Physical topics include convection and diffusion as the simplest models of transport; local conservation laws with sources as the general framework of continuum mechanics; ideal fluid as the simplest model of a medium with mass; momentum and energy transport; and finally, free surface waves, in particular, shallow water theory.

There is a strong emphasis on dimensional analysis and scaling. Some topics, such as physical similarity and similarity solutions, are traditional. In addition, there are reductions based on scaling, such as incompressible flow as a limit of compressible flow, and shallow water theory derived asymptotically from the full equations of free surface waves. More and deeper examples are presented as problems, including a series of problems that model a tsunami approaching the shore.

The problems form an embedded subtext to the book. Each problem is followed by a detailed solution emphasizing process and craftsmanship. The problems express the practice of applied mathematics as the examination and re-examination of simple but essential ideas in many interrelated examples.