

FREE BOUNDARY PROBLEMS: THEORY, NUMERICAL ANALYSIS AND APPLICATIONS

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ABSTRACT

Problems in which the solution of a differential equation has to satisfy certain conditions on the boundary of a prescribed domain are referred to as boundary-value problems. In many important cases, the boundary of the domain is not known in advance but has to be determined as part of the solution. The term “free boundary problem” is used when the boundary is stationary (steady-state or elliptic problems) or moving with time (time-dependent or parabolic problems) and in this case the position of the boundary has to be determined as a function of time and space. In all cases, two conditions are needed on the free boundary, one to determine the boundary itself and the other to complete the definition of the solution of the differential equation. Moreover, suitable conditions on the fixed boundaries and, where appropriate, an initial condition are also prescribed as usual.

In the last decades the number of works on free boundary problems, particularly regarding on the heat-diffusion equation, has increased dramatically. This fact was motivated by the more and more frequent occurrence of such problems in a wide range of application (phase-change processes (melting, freezing, thawing, sublimation, evaporation, ablation, drying, supercooled liquid, permafrost ground, food or biological material conservation, binary alloy solidification, crystal growth, thermal welding, metal casting, thermal storage systems for solar energy), filtration and fluid flow in porous media, unsaturated flow, Hele-Shaw flow, chemical and gas-solid reactions, oxygen diffusion-consumption in an absorbing tissue, coupled heat and mass transfer, combustion, lubrication, Bingham flow, elastic-plastic torsion problem, electrochemical machining, root growth, optimal stopping, american options in finance, dam problem, obstacle problems, etc.).

The goal of the minisymposium is the study of free boundary problems from the modelling, theoretical, numerical, and application point of view.