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Recent Advances in Free Boundary Problems

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Preface

During the last decade free boundary problems have become an established research area, focusing interest of scientists representing various domains. Physical roots bring about motivation for applications oriented research, at the same time intrinsically non-conventional structure of the models attracts attention of numerous mathematicians. Equally theoretical studies and numerical treatment of the problems resulted in many stimulating publications.

The present volume comprises papers devoted to various kinds of free boundary problems, invited according to two keys — practical significance of the processes modelled on the one hand, and mathematical interest of the offered results on the other. This is reflected by the structure of the volume.

Part I contains contributions concerned with construction of mathematical models for selected classes of practically important dynamical processes combined with phase transitions. Those papers discuss origin of a number of variants of the models and develop techniques of their numerical simulation. Also some new techniques of parameter identification and control for such processes are exposed. Among physical processes under consideration let us mention soil freezing, induction heating, alloy solidification, chemical reactions, thermocapillary motion, ferromagnetism, multi-phase flows in porous media and thermal coating.

The papers of Part II concern mainly mathematical techniques of the theoretical analysis for several types of free boundary problems. The results exposed are related to various evolution problems of not only standard, reversible form but also admitting effects of irreversibility (in particular, reflected by presence of a hysteresis in some constitutive relationships) and non-correctness (structural instabilities). Besides, new results on classical stationary problems are exposed.

This volume appears as a special issue of "Control and Cybernetics". The editors of this issue would like to express special gratitude to Prof. K. Malanowski, the former editor-in-chief of the journal, who has initiated the idea

of such monographic editions offering a kind of state-of-the-art overviews. Certainly, the selection of the topics, as done by the editors of the issue, should be viewed as reflecting, at least to some extent, personal interests and preferences. The planned further volumes are intended as more homogeneous, each of them focused on a single theme, therefore providing an actually comprehensive and representative set of information.

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