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# **Free Boundary Problems in Continuum Mechanics**

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**Birkhäuser**

# Free Boundary Problems In Continuum Mech

**Karl-Heinz Hoffmann**



## Free Boundary Problems In Continuum Mech:

Free Boundary Problems in Continuum Mechanics Stanislav Nikolaevich Antontsev, Karl-Heinz Hoffmann, A. M. Khludnev, 1992 Some extremum and unilateral boundary value problems in viscous hydrodynamics On axisymmetric motion of the fluid with a free surface On the occurrence of singularities in axisymmetrical problems of Hele-Shaw type New asymptotic method for solving of mixed boundary value problems Some results on the thermistor problem New applications of energy methods to parabolic and elliptic free boundary problems A localized finite element method for nonlinear water wave problems Approximate method of investigation of normal oscillations of viscous incompressible liquid in container The classical Stefan problem as the limit case of the Stefan problem with a kinetic condition at the free boundary A mathematical model of oscillations energy dissipation of viscous liquid in a tank Existence of the classical solution of a two phase multidimensional Stefan problem on any finite time interval Asymptotic theory of propagation of nonstationary surface and internal waves over uneven bottom Multiparametric problems of two dimensional free boundary seepage Nonisothermal two phase filtration in porous media Explicit solution of time dependent free boundary problems Nonequilibrium phase transitions in frozen grounds System of variational inequalities arising in nonlinear diffusion with phase change Contact viscoelastoplastic problem for a beam Application of a finite element method to two dimensional contact problems Computations of a gas bubble motion in liquid Waves on the liquid gas free surface in the presence of the acoustic field in gas Smooth bore in a two layer fluid Numerical calculation of movable free and contact boundaries in problems of dynamic deformation of viscoelastic bodies On the canonical variables for two dimensional vortex hydrodynamics of incompressible fluid About the method with regularization for solving the contact problem in elasticity Space evolution of tornado like vortex core Optimal shape design for parabolic system and two phase Stefan problem Incompressible fluid flows with free boundary and the methods for their research On the Stefan problems for the system of equations arising in the modelling of liquid phase epitaxy processes Stefan problem with surface tension as a limit of the phase field model The modelization of transformation phase via the resolution of an inclusion problem with moving boundary To the problem of constructing weak solutions in dynamic elastoplasticity The justification of the conjugate conditions for the Euler's and Darcy's equations On an evolution problem of thermo capillary convection Front tracking methods for one dimensional moving boundary problems On Cauchy problem for long wave equations On fixed point trial methods for free boundary problems Nonlinear theory of dynamics of a viscous fluid with a free boundary in the process of a solid body wetting

**Free Boundary Problems in Continuum Mechanics** S.N. Antontsev, K.H. Hoffmann, A.M. Khludnev, 2012-01-06

**Free Boundary Problems in Continuum Mechanics** S.N. Antontsev, K.H. Hoffmann, A.M. Khludnev, 2013-03-07 Progress in different fields of mechanics such as filtration theory elastic plastic problems crystallization processes internal and surface waves etc is governed to a great extent by the advances in the study of free boundary problems for nonlinear partial differential equations Free

boundary problems form a scientific area which attracts attention of many specialists in mathematics and mechanics. Increasing interest in the field has given rise to the International Conferences on Free Boundary Problems and Their Applications which have convened since the 1980s in such countries as England, the United States, Italy, France, and Germany. This book comprises the papers presented at the International Conference Free Boundary Problems in Continuum Mechanics organized by the Lavrentyev Institute of Hydrodynamics, Russian Academy of Sciences, July 15-19, 1991, Novosibirsk, Russia. The scientific committee consisted of Co-chairmen K. H. Hoffmann, L. V. Ovsiannikov, S. Antontsev, Russia, J. Ockendon, UK, M. Fremond, France, L. Ovsiannikov, Russia, A. Friedman, USA, S. Pokhozhaev, Russia, K. H. Hoffmann, Germany, M. Primicerio, Italy, A. Khludnev, Russia, V. Pukhnachov, Russia, V. Monakhov, Russia, Yu. Shokin, Russia, V. Teshukov, Russia. Our thanks are due to the members of the Scientific Committee, all authors and participants for contributing to the success of the Conference. We would like to express special appreciation to N. Makarenko, J. Mal'tseva, and T. Savelieva, Lavrentyev Institute of Hydrodynamics, for their help in preparing this book for publication.

**Energy Methods for Free Boundary Problems**

S.N. Antontsev, J.I. Díaz, S. Shmarev, 2001-10-26. For the past several decades the study of free boundary problems has been a very active subject of research occurring in a variety of applied sciences. What these problems have in common is their formulation in terms of suitably posed initial and boundary value problems for nonlinear partial differential equations. Such problems arise, for example, in the mathematical treatment of the processes of heat conduction, filtration through porous media, flows of non-Newtonian fluids, boundary layers, chemical reactions, semiconductors, and so on. The growing interest in these problems is reflected by the series of meetings held under the title Free Boundary Problems: Theory and Applications: Oxford 1974, Pavia 1979, Durham 1978, Montecatini 1981, Maubuisson 1984, Irsee 1987, Montreal 1990, Toledo 1993, Zakopane 1995, Crete 1997, Chiba 1999. From the proceedings of these meetings we can learn about the different kinds of mathematical areas that fall within the scope of free boundary problems. It is worth mentioning that the European Science Foundation supported a vast research project on free boundary problems from 1993 until 1999. The recent creation of the specialized journal *Interfaces and Free Boundaries: Modeling, Analysis, and Computation* gives us an idea of the vitality of the subject and its present state of development. This book is a result of collaboration among the authors over the last 15 years.

**Energy Methods in Continuum Mechanics**

S.N. Antontsev, J.I. Díaz, S.I. Shmarev, 2012-12-06. This volume contains the proceedings of the Workshop Energy Methods for Free Boundary Problems in Continuum Mechanics held in Oviedo, Spain, from March 21 to March 23, 1994. It is well known that the conservation laws and the constitutive equations of Continuum Mechanics lead to complicated coupled systems of partial differential equations to which, as a rule, one fails to apply the techniques usually employed in the studies of scalar uncoupled equations, such as, for instance, the maximum principle. The study of the qualitative behaviour of solutions of the systems requires different techniques; among others, the so-called Energy Methods, where the properties of some integral of a nonnegative function of one or several unknowns allow one to arrive at important

conclusions on the involved unknowns This volume presents the state of the art in such a technique A special attention is paid to the class of Free Boundary Problems The organizers are pleased to thank the European Science Foundation Program on Mathematical treatment of free boundary problems the DGICYT Spain the FICYT Principado de Asturias Spain and the Universities of Oviedo and Complutense de Madrid for their generous financial support Finally we wish to thank Kluwer Academic Publishers for the facilities received for the publication of these Proceedings

Free Boundaries in Rock Mechanics Anvarbek Meirmanov, Oleg V. Galtsev, Reshat N. Zimin, 2017-09-11 This monograph is concerned with free boundary problems of partial differential equations arising in the physical sciences and in engineering The existence and uniqueness of solutions to the Hele Shaw problem are derived and techniques to deal with the Muskat problem are discussed Based on these mathematical models for the dynamics of cracks in underground rocks and in situ leaching are developed Contents Introduction The Hele Shaw problem A joint motion of two immiscible viscous fluids Mathematical models of in situ leaching Dynamics of cracks in rocks Elements of continuum mechanics

Free Boundary Problems Involving Solids J M Chadam, Helen Rasmussen, 1993-02-22 This is the second of three volumes containing the proceedings of the International Colloquium Free Boundary Problems Theory and Applications held in Montreal from June 13 to June 22 1990 The main theme of this volume is the concept of free boundary problems associated with solids The first free boundary problem the freezing of water the Stefan problem is the prototype of solidification problems which form the main part of this volume The two sections treating this subject cover a large variety of topics and procedures ranging from a theoretical mathematical treatment of solvability to numerical procedures for practical problems Some new and interesting problems in solid mechanics are discussed in the first section while in the last section the important new subject of solid solid phase transition is examined

**A Bibliography of Free Boundary Problems** Colin W. Cryer, 1977 A free boundary problem is a steady state boundary value problem involving differential equations on domains parts of whose boundaries the free boundaries are unknown and must be determined as part of the solution Free boundary problems arise in all branches of continuum mechanics The bibliography contains about 3300 references most of which are classified according to one or more of approximately 1200 subjects Listings by author and by subject are given in appendices these are on microfiche but paper copies can be obtained by writing to the Mathematics Research Center Author

**Energy Methods for Free Boundary Problems** S.N. Antontsev, J.I. Diaz, S. Shmarev, 2012-12-06 For the past several decades the study of free boundary problems has been a very active subject of research occurring in a variety of applied sciences What these problems have in common is their formulation in terms of suitably posed initial and boundary value problems for nonlinear partial differential equations Such problems arise for example in the mathematical treatment of the processes of heat conduction filtration through porous media flows of non Newtonian fluids boundary layers chemical reactions semiconductors and so on The growing interest in these problems is reflected by the series of meetings held under the title Free Boundary Problems Theory and Applications

Oxford 1974 Pavia 1979 Durham 1978 Montecatini 1981 Maubuisson 1984 Irsee 1987 Montreal 1990 Toledo 1993 Zakopane 1995 Crete 1997 Chiba 1999 From the proceedings of these meetings we can learn about the different kinds of mathematical areas that fall within the scope of free boundary problems It is worth mentioning that the European Science Foundation supported a vast research project on free boundary problems from 1993 until 1999 The recent creation of the specialized journal *Interfaces and Free Boundaries Modeling Analysis and Computation* gives us an idea of the vitality of the subject and its present state of development This book is a result of collaboration among the authors over the last 15 years

**Free Boundary Problems** Karl-Heinz Hoffmann, 1990 *Energy Methods for Free Boundary Problems* Stanislav Nikolaevich Antontsev, J. I. Díaz, S. I. Shmarev, 2002

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*Emerging Applications in Free Boundary Problems* J M Chadam, 2020-12-22 This Research Note presents a collection of papers on emerging applications in free boundary problems The subjects covered include microgravity chemical and biological reactions and electromagnetism and electronics

*A Variational Inequality Approach to free Boundary Problems with Applications in Mould Filling* Jörg Steinbach, 2012-12-06 Since the early 1960s the mathematical theory of variational inequalities has been under rapid development based on complex analysis and strongly influenced by real life application Many but of course not all moving free Le a priori unknown boundary problems originating from engineering and economic applications can directly or after a transformation be formulated as variational inequalities In this work we investigate an evolutionary variational inequality with a memory term which is as a fixed domain formulation the result of the application of such a transformation to a degenerate moving free boundary problem This study includes mathematical modelling existence uniqueness and regularity results numerical analysis of finite element and finite volume approximations as well as numerical simulation results for

applications in polymer processing Essential parts of these research notes were developed during my work at the Chair of Applied Mathematics LAM of the Technical University Munich I would like to express my sincerest gratitude to K H Hoffmann the head of this chair and the present scientific director of the Center of Advanced European Studies and Research caesar for his encouragement and support With this work I am following a general concept of Applied Mathematics to which he directed my interest and which based on application problems comprises mathematical modelling mathematical and numerical analysis computational aspects and visualization of simulation results

**Free Boundary Problems, Theory and Applications** Marek Niezgodka, Pawel Strzelecki, 1996-11-25 Addressing various aspects of nonlinear partial differential equations this volume contains papers and lectures presented at the Congress on Free boundary Problems Theory and Application held in Zakopane Poland in 1995 Topics include existence uniqueness asymptotic behavior and regularity of solutions and interfaces

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**Free Boundary Problems** J I Diaz, Juan Luis Vazquez, M A Herrero, Amable Linan, 1995-04-04 This research note consists of selected contributions from the 1993 International Conference on Free Boundary Problems Theory and Applications These represent coherent and high level research in the field of free boundary problems Topics include mean curvature flows phase transitions and material sciences fluid mechanics and combustion problems

*Free Boundary Problems in Fluid Flow with Applications* J M Chadam, Helen Rasmussen, 1993-02-22 This is the third of three volumes containing the proceedings of the International Colloquium Free Boundary problems Theory and Applications held in Montreal from June 13 to June 22 1990 The main part of this volume studies the flow of fluids an area which has led to many of the classical free boundary problems

The first two sections contain the papers on various problems in fluid mechanics The types of problems vary from the collision of two jets to the growth of a sand wave In the next two sections porous flow is considered This has important practical applications in fields such as petroleum engineering and groundwater pollution Some new and interesting free boundary problems in geology and engineering are treated in the final section

**Modelling and Control in Solid Mechanics** A. M. Khludnev, Jan Sokołowski, 1997 This book covers the boundary value problems for a wide range of mathematical models of the mechanics of deformable bodies in particular the boundary value problems concerning plates and shells crack theory and elastoplastic bodies An essential feature of the discussed boundary value problems is the availability of the inequality type constraints imposed on solutions such as the impenetration condition for contact problems the yield plasticity condition etc As a consequence the presence of free boundaries is typical of the boundary value problems concerned The objective of the book is to display some new methods of analyzing such problems as well as to perform research on new models evolved from engineering practice Readers will find a variety of new mathematical models describing some contact problems for plates and shells an equilibrium of plates involving cracks etc Furthermore some new mathematical methods are presented which were specially developed by the authors to study the problems concerned These help to convey a comprehensive picture of the present state of mathematical problems on the free boundary elasticity and plasticity theory The book is intended for postgraduates scientists and engineers and for Students interested in problems of modelling and optimal control in the mechanics of deformable bodies



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