The Stefan Problem

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In mathematics and its applications, particularly to phase transitions in matter, a Stefan problem is a particular kind of boundary value problem for a system of partial differential equations (PDE), in which the boundary between the phases can move with time.

Stefan problem - Wikipedia
The definition of the weak solution of a Stefan problem is based on the classical formulation of the Stefan problem. For simplicity, first a weak formulation of a one-dimensional two-phase Stefan problem will be defined in the region 0 □ x □ 1. For multi-dimensional Stefan problems, weak formulations can be defined similarly (see § 11.2.1).

Stefan Problem - an overview | ScienceDirect Topics
The Stefan Problem (Translations of Mathematical Monographs : Vol. 27) First Edition by L. I. Rubinstein (Author) See all formats and editions Hide other formats and editions

The Stefan Problem (Translations of Mathematical ...
Stefan problem A problem that arises when studying physical processes related to phase transformation of matter.

Stefan problem - Encyclopedia of Mathematics
Stefan Problem The Stefan Problem Also, Stefan problems can be applied to describe phase transformations. The Stefan problem also has a rich inverse theory; in such problems, the meting depth (or curve or hypersurface) s is the known datum and the problem is to find u or f. Advanced forms of Stefan problem Stefan problem - Page 4/26

The Stefan Problem - chimerayanartas.com
Appears in 3 books from 1971-1999 Page 1 - In this work the problem was posed of determining the thickness of the solid crust generated by the cooling of a liquid filling the halfspace x > 0 under...

The Stefan Problem - L. I. Rubinshteĭn - Google Books
The Stefan condition The Stefan problem () is probably the simplest mathematical model of a phenomenon of change of phase. When a change of phase takes place, a latent heat is eitherabsorbedor released, whilethe temperatureofthematerialchanging its phase remains constant.

Lecture notes on the Stefan problem
The Stefan problem in the classical statement is a mathematical model of the propagation of heat in a medium, being in different phase states, e.g., liquid and solid ones Due to the melting or...

(PDF) Stefan problem - ResearchGate
The classical Stefan problem is a solidification and a melt- ing problem, for example the transition between ice and water. To acquire a solutionfortheclassicalStefanproblem,theheatequationneedstobesolved.

Ontheonedimensional Stefanproblem
Fluid Dynamics Seminar. Abstract: "Fluids sculpt many of the shapes we see in the world around us. We present a new mathematical model describing the shape evolution of a body that dissolves or melts under gravitationally stable buoyancy-driven convection, driven by thermal or solutal transfer at the solid-fluid interface.

The convective Stefan problem: Shaping of solids under ...
SOME REMARKS ON THE STEFAN PROBLEM 351 Letting t = s □ zH in this integral, we find that (15a) H =-7-^7-s exp (-t2/S - 2zHt/Ô) dt, 5 exp ízh2/ki) Jo so that as A increases, the integral in (15a) must decrease; since zH decreases with increasing .4, z2B □ zB must decrease and so z2B must decrease as well. However, by

Some Remarks on the Stefan Problem*
Roughly speaking, the Stefan problem consists on determining the temperature distribution in a medium undergoing a phase change. This book describes the analytical side of the problem from the first existence and uniqueness results obtained in the first half of the twentieth to approximately 1987.

The Stefan Problem (Degruyter Expositions in Mathematics ...
Problems on Stefan Boltzmann Law Example: A body of emissivity (e = 0.75), the surface area of 300 cm 2 and temperature 227 ºC are kept in a room at temperature 27 ºC. Using the Stephens Boltzmann law, calculate the initial value of net power emitted by the body. Using equation (3);

Stefan Boltzmann Law - Derivation, Formula, Equation, Examples
The Stefan problem. [Lev I Rubinštejn] Home. WorldCat Home About WorldCat Help. Search. Search for Library Items Search for Lists Search for Contacts Search for a Library. Create lists, bibliographies and reviews: or Search WorldCat. Find items in libraries near you. Advanced Search Find a Library ...

The Stefan problem (Book, 1971) [WorldCat.org]
The Stefan problem. [Anvarbek M Mejrmanov] Home. WorldCat Home About WorldCat Help. Search. Search for Library Items Search for Lists Search for Contacts Search for a Library. Create lists, bibliographies and reviews: or Search WorldCat. Find items in libraries near you ...

The Stefan problem (Book, 1992) [WorldCat.org]
Essentially, after a cursory comment, Stefan describes the problem of the freezing of a column of ice in contact with a column of water of a higher temperature, with no indication as to his motivation. There is no reference to previous calculations, or to observations or analogies that might have motivated his theoretical analysis.

The Stefan Problem: Polar Exploration and the Mathematics ...
The Stefan problem is an initial-boundary value problem of a parabolic differential equation with discontinuous coefficients on the phase change interfaces. The phase change occurs for a given value of temperature (freezing point), where the energy balance on the interface is written in

An Accurate Approximation of the Two-Phase Stefan Problem ...
The one-phase Stefan problem describes evolution of the temperature and melting-solidification front in liquid-solid material. The setting models an industrial casting process, and experiments have revealed the existence of hysteresis due to boiling of the cooling water at the surface of the casting process.

Enthalpy-based Output Feedback Control of the Stefan ...
Problem 4 - The Stefan-Boltzmann Formula (7) 10-16 T = 1SOOK T1000K 10-17 Energy-clensily function (J/m?) 10-18 10"19 T-SOOK 10-20 1012 10 1013 1014 Frequency (Hz) Based on the work of Gustav Robert Kirchoff, Wilhelm Wien, Lord Rayleigh and James Jean, in 1900 Max Planck was able to determine the energy density for emission of black body radiation as a function of temperature and frequency, u ...

This volume emphasises studies related to classical Stefan problems. The term "Stefan problem" is generally used for heat transfer problems with phase-changes such as from the liquid to the solid. Stefan problems have some characteristics that are typical of them, but certain problems arising in fields such as mathematical physics and engineering also exhibit characteristics similar to them. The term ``classical'' distinguishes the formulation of these problems from their weak formulation, in which the solution need not possess classical derivatives. Under suitable assumptions, a weak solution could be as good as a classical solution. In hyperbolic Stefan problems, the characteristic features of Stefan problems are present but unlike in Stefan problems, discontinuous solutions are allowed because of the hyperbolic nature of the heat equation. The numerical solutions of inverse Stefan problems, and the analysis of direct Stefan problems are so integrated that it is difficult to discuss one without referring to the other. So no strict line of demarcation can be identified between a classical Stefan problem and other similar problems. On the other hand, including every related problem in the domain of classical Stefan problem would require several volumes for their description. A suitable compromise has to be made. The basic concepts, modelling, and analysis of the classical Stefan problems have been extensively investigated and there seems to be a need to report the results at one place. This book attempts to answer that need.

The aim of the series is to present new and important developments in pure and applied mathematics. Well established in the community over two decades, it offers a large library of mathematics including several important classics. The volumes supply thorough and detailed expositions of the methods and ideas essential to the topics in question. In addition, they convey their relationships to other parts of mathematics. The series is addressed to advanced readers wishing to thoroughly study the topic. Editorial Board Lev Birbrair, Universidade Federal do Ceará, Fortaleza, Brasil Victor P. Maslov, Russian Academy of Sciences, Moscow, Russia Walter D. Neumann, Columbia University, New York, USA Markus J. Pflaum, University of Colorado, Boulder, USA Dierk Schleicher, Jacobs University, Bremen, Germany

The Classical Stefan Problem: Basic Concepts, Modelling and Analysis, Second Edition, provides the fundamental theoretical concepts, modeling, and analysis of the physical, mathematical, thermodynamical, and metallurgical properties of classical Stefan and Stefan-like problems applied to heat transfer problems with phase-changes, such as from liquid to solid. This self-contained work reports and derives the results from tensor analysis, differential geometry, non-equilibrium thermodynamics, physics, and functional analysis. The text is enriched with many appropriate references for in-depth background reading on theorems. Each chapter begins with basic concepts, objectives, and the directions in which the subject matter has developed. This is followed by detailed reviews of published works. This updated edition is fully revised, and contains more than 150 pages of new material on quasi-analytical solutions and methods of classical Stefan and Stefan-like problems. Provides both the phenomenology and mathematics of Stefan problems Bridges physics and mathematics in a concrete and readable way Presents well-organized chapters that start with proper definitions that are followed by explanations and end with references for further reading Includes both numerical and quasi-analytical solutions and methods of classical Stefan and Stefan-like problems

In this monograph the theory and methods of solving inverse Stefan problems for quasilinear parabolic equations in regions with free boundaries are developed. The study of this new class of ill-posed problems is motivated by the needs of the mod eling and control of

nonlinear processes with phase transitions in thermophysics and mechanics of continuous media. Inverse Stefan problems are important for the perfection of technologies both in high temperature processes (e.g., metallurgy, the aircraft industry, astronautics and power engineering) and in hydrology, exploitation of oil-gas fields, etc. The proposed book will complete a gap in these subjects in the preceding re searches of ill-posed problems. It contains the new theoretical and applied studies of a wide class of inverse Stefan problems. The statements of such problems on the determination of boundary functions and coefficients of the equation are considered for different types of additional information about their solution. The variational method of obtaining stable approximate solutions is proposed and established. It is implemented by an efficient computational scheme of descriptive regularization. This algorithm utilizes a priori knowledge of the qualitative structure of the sought solution and ensures a substantial saving in computational costs. It is tested on model and applied problems in nonlinear thermophysics. In particular, the results of calculations for important applications in continuous casting of ingots and in the melting of a plate with the help of laser technology are presented.

An algorithm is proposed for solving one-dimensional free boundary problems with change of phase. The technique consists of solving the heat equation in progressively increasing rectangles whose size is controlled by the Stefan condition. Convergence of the scheme is shown and an estimate of the rate of convergence is given. (Author).

This is a version of Gevrey's classical treatise on the heat equations. Included in this volume are discussions of initial and/or boundary value problems, numerical methods, free boundary problems and parameter determination problems. The material is presented as a monograph and/or information source book. After the first six chapters of standard classical material, each chapter is written as a self-contained unit except for an occasional reference to elementary definitions, theorems and lemmas in previous chapters.