Extreme Methods for Solving Ill-Posed Problems with Applications to Inverse Heat Transfer Problems

O.M. Alifanov
E.A. Artyukhin
S.V. Rumyantsev

begell house, inc.
New York • Wallingford (U.K.)

Extreme Methods for Solving Ill-posed Problems with Applications to Inverse Heat Transfer Problems

Library of Congress Cataloging-in-Publication Data

Alifanov, O. M. (Oleg Mikhaĭlovich)
[Ėkstremal ́nye metody resheniia nekorrektnykh zadach I ikh prilozheniia k obratnym zadacham teploobmena. English]
Extreme methods for solving ill-posed problems with applications to inverse heat transfer problems / O.M. Alifanov, E.A. Artyukhin, S.V. Rumyantsev.
p. cm.
Includes bibliographical references (p.).
ISBN 1-56700-038-X (hardcover)
1. Numerical analysis--Improperly posed problems. 2. Extremal Problems (Mathematics) 3. Heat--Transmission- -Mathematics. 4. Numerical analysis. I. Artiukhin, E. A. (Evgeniĭ Alekseevich) II. Rumiantsev, S. V. (Sergeĭ Vladimirovich) III. Title.
QA297.A515 1995
536.2'01'5194--dc20 95-44086
CIP

CONTENTS

FOREWORD to the English Language Edition

I am honored to write a foreword for this book for a number of reasons. One is that I have been privileged to meet personally each of the authors many times and to have lengthy technical discussions with them. We have conversed in Russia, in the United States and in France. There have been joint technical meetings in Moscow and St. Petersburg in Russia and in East Lansing, Michigan (some of which have had US and Russian government support) as well as other places where we met and discussed inverse problems in heat transfer. Such meetings are very important for the advancing of this research area.

Another reason is that the research and methods *complement* the work done in the United States and elsewhere in the West. With the exception of a book written by Dean Alifanov, there is no other comparable book in English that has the same mathematical depth for solving inverse heat transfer problems using the iterative regularization method. This book has the potential of greatly affecting research in the English-speaking world in a large range of inverse heat transfer problems. The iterative regularization method has many advantages including generality and substantial mathematical underpinning.

Yet another reason is the importance of the general topic. Inverse problems in heat transfer involve combining of analysis and experimentation in a more powerful way than is frequently done in heat transfer and in other fields. The name "new research paradigm" has been suggested. By using the techniques in this book, it is possible to estimate parameters and functions that cannot be found by using techniques now commonly used by experimenters. Furthermore the book discusses how experiments can lead to substantial advances in many facets of engineering, medicine, geology and other fields.

The final reason is that this book is tangible proof of *international cooperation* in engineering and mathematics. We in the United States and other English-speaking countries are indeed fortunate to have this book.

James V. Beck
East Lansing, Michigan

FOREWORD

The theory of ill-posed problems, whose fundamentals were developed by Academician A. N. Tikhonov and some other prominent Soviet mathematicians, is rather new but thriving direction in computational mathematics. Permanent interest to its results can be ascribed primarily to its continuously extending sphere of applications to quite different fields of science and technology and to advances in computer science.

Inverse problems, that require determination of a set of causal characteristics from measurements of a system or a process state, present the widest range of application of the ill- posed problem theory. The disturbance of the natural cause-effect relations results in ill-posedness of inverse problems. Many problems of mathematical model identification are ill-posed. They are to be also used in the cases when required characteristics of the process studied are inaccessible for direct observation.

Effective methods developed for solving inverse problems have allowed researchers to simplify considerably experiments, to increase the accuracy and the confidence of results obtained by a certain complication of algorithms for experimental data processing. The part of work done by a computer increases more and more and that reduces time and cost of experimental studies and facilitates their further computerization.

In view of the above, development of effective methods for solving ill-posed problems and computational algorithms for specific applied problems is now of great interest.

This monograph is based on the authors' studies carried out to investigate one of the most promising trends in the theory of ill-posed problems, namely, iterative regularization and its application to inverse heat transfer problems. The studies have been conducted effectively at Moscow Aviation Institute by a group of researchers directed by Prof. O. M. Alifanov. He has obtained important results in methodology of solution of ill-posed inverse heat transfer problems and it was he who suggested the iterative regularization method. Efficiency and simplicity of the algorithms and versatility of the iterative regularization method enhanced the development and implementation of the method in practice as well as expansion of classes of the problems which can be solved by the use of this method. The authors consistently discuss a broad range of problems concerned with both the theory of regularizing gradient algorithms and peculiarities of their application to the most often encountered inverse problems of reconstruction of external heat fluxes and the identification of mathematical models for heat transfer processes. Great attention is paid to the synthesis of effective computational algorithms, including calculation of the residual gradient and including apriori information on the desired solution. The ways of increasing the data accuracy by optimal experimental design are considered. The discussion is exampified by results of model experiments that show high efficiency of the algorithms suggested for a wide class of inverse problems.

Undoubtedly, the book may be of interest for both researches of the theory of ill-posed problems and those interested in its applications to inverse heat transfer problems.

V. A. Mel'nikov

PREFACE

The fundamentals of the theory of ill-posed problems, the regularization theory, were developed in the 1950's – 1960's by Soviet mathematicians A. N. Tikhonov, V. K. Ivanov and M. M. Lavrentiev. Its rapid development in recent years, especially, after publication of A. N. Tikhonov's fundamental articles [190, 191] can be attributed, first, to continuous expansion of the field of practical applications of the theory and second, to substantial advances in computer science. The wide use of computational experiment which reduces not only the time but also the cost of research and development has encouraged practical application of the ill-posed problem theory. The computational experiment is of special importance in computerization of research and design of structures in modern engineering. The problems of structural and parametric identification of mathematical models often appear ill-posed. Ill-posed problems frequently arise in data processing in physical experiments.

In recent years a number of theoretical monographs concerned with the theory of ill-posed problems have been published [72, 90, 117, 122, 142, 187, 193, 196]. However, the monographs actually ignore one of the promising direction in the development of the regularization theory which is widely used, in particular, when solving thermophysical problem. That direction, which can be called "iterative regularization", consists in the construction of regularizing algorithms on the basis of various iterative methods, with an iteration number as the regularization parameter. Many iterative methods, including gradient techniques, are rather resistant to errors in the input data: in the initial iterations the produced approximations differ very little from the corresponding approximations obtained with exact input data and the errors gradually increase as the iteration number rises. Therefore, it is natural to try to get stable approximations, by stopping the iterative process at a certain iteration number consistent with the error in the initial data. M. M. Lavrentiev was the first who used the idea [116].

The simple iteration method is the most convenient for the analysis because it is linear. With exact initial data, its convergence for equations with a continuous linear operator, having no bounded inverse, has been proved by V. M. Friedman [208] who also proved convergence for nonlinear gradient methods of the steepest descent type [207]. B. A. Morozov [140] and A. B. Bakushinsky [40] have obtained complete enough results on the regularizing properties of the simple iteration method. This method was then analyzed in [42, 111, 171, 182, 183, 234, 235]. However, no specific ways were indicated in the publications for the choice of the regularization parameter (the iteration number). The residual criterion for choosing the regularization parameter when the operator is exactly prescribed has been justified in [40, 83]. A thechnique for the choice of the parameter, taking into consideration computational errors, has been suggested and justified in [84]. In [56, 57], techniques for choosing the regularization parameter are considered by accounting errors in both the right-hand side and the operator, in particular, a residual criterion and a generalized residual criterion, estimation of errors in corresponding regularization algorithms is given and their optimality in order is shown. In [61] choice of the regularization parameter based on the iterative process "stacking" is justified when both errors in the operator and the right-hand side and the computational errors are taken into account. It should be noted that error estimates for regularizing algorithms were obtained under the assumption of source-like representability of a desired solution that could be a strong enough condition. For example, in boundary inverse heat conduction problems of reconstructing the boundary condition of the first or second kind $u(\tau)$ defined at the interval $[0, \tau_m]$, the equality $u(\tau_m) = 0$ is the necessary condition for the source- like representability of $u(\tau)$, i.e. at least $u(\tau_m)$ must be known which is extremely rarely occure in practice.

It is known that the gradient minimization methods of the steepest descent and conjugate gradient types are more effective when solving well-posed problems compared with the simple iteration method. However, investigation of applicability of the methods to ill-posed problems is very difficult because of their nonlinearity even for linear problems. Therefore gradient-based regularizing iterative algorithms for linear operator equations have been obtained only recently. Convergence of the gradient methods with exact initial data is analyzed in [68, 207, 228, 231]. Regularizing algorithms built on their basis when errors in the operator and the right-hand side take place, including the justification of the residual criterion and generalized residual criterion, are considered in [24, 25, 69, 70, 169, 174, 175]. Publications [38, 39, 170] deal with taking into account of apriori information on the unknown solution in the regularizing gradient algorithms. A regularizing iterative algorithm besed on the implicit iterative scheme is considered in [198].

It should be emphasized that the methods with a higher convergence rate, such as the Newton methods, are invalid for iterative regularization since in a linear case they are reduced to direct inversion of the operator in the initial equation, but in nonlinear problems they require inversion of the derivative of the operator that has no bounded inverse in ill-posed problems. Of course, this fact does not exclude application of the Newton methods in other regularization forms, e.g., in that analyzed in [41, 59] where regularization is performed by introducing appropriate additives into the iterative algorithm itself.

The above studies concerned with iterative regularization were fundamental for this branch of the theory of ill-posed problems. Consistent presentation of corresponding results and their further development is the main goal of this book.

Whereas the iterative regularization of linear ill-posed problems has been studied at present fully enough, there are actually no publications devoted to nonlinear problems; isolated results are presented in [92, 149]. Meanwhile, as it has been shown by computational experiments, the iterative algorithms for nonlinear ill-posed problems formally based on the same scheme as for the linear problems, appear to be quite effective. The results encourage further investigations of iterative algorithms for nonlinear inverse problems in a general case.

Great attention is paid in the book to the various computational aspects of iterative regularization implementation, particularly, that associated with determination of residual functional gradients, development of modified gradient algorithms for multiparametric problems, including those taking into consideration the qualitative and quantitative apriori information on the unknown quantities.

The second goal of the book is application of the method developed to some ill-posed thermal problems, namely, inverse heat transfer problems. Among them, boundary and coefficient inverse heat conduction problems (IHCP) can be mentioned primarily which certainly do not exhaust the sphere of applications of iterative regularization. IHCPs have been chosen by two reasons. First, it is an important enough class of the problems of mathematical physics that has recently become widely used in some fields of science and technology such as mechanical engineering, aerospace industry, power engineering, metallurgy, etc. Second, inverse heat conduction problems are diverse in forms and statements, ill-posedness degree, and, therefore, they appear to be very convenient for testing the efficiency of methods and algorithms of the regularization theory.

The methodology based on solving inverse problems is a new lead in the investigation of heat and mass transfer processes, development and optimization of thermal conditions of engineering objects and production processes. Rather high interest to solution of these problems is induced by practical needs of including of nonstationary and nonlinear effects in heat and mass transfer processes. These effects restrict essentially the application of classical methods and necessitate the development of new approaches, among which there are methods based on solving inverse heat and mass transfer problems. Their main advantage is that they allow experiments to be conducted in conditions maximally close to real ones, or directly during operation of real objects. Besides, the new approach increases the informativeness, saves experimentation time compared with conventional methods. A reduction of the cost is an important quality of the methods as well.

At present, to solve inverse heat transfer problems algorithms are extensively developed on the basis of the variational technique for construction of regularizing operators, step regularization of approximate analytical and difference forms of solution and step regularization of linear filtration algorithms [2, 3, 5, 9, 51, 85, 105, 106, 112, 130, 131, 147, 151, 179, 195, 211, 214, 221]. Now there is a large amount of relevant publications. They are surveyed in [9, 106, 131]. The analysis of results of computational experiments and practical applications of the above approaches to the solution of inverse heat transfer problems in comparison with iterative regularization has allowed a conclusion to be made that regularizing gradient algorithms are extremely advantageous for inverse problems of various forms and statements, including nonlinear, multidimensional, overdefined ones, because of their simplicity and versatility of algorithmic constructions. Their important strength is the ability to use this approach for problems, whose statements include limitations on the class of admissible solutions. This factor is of special importance since the quality of approximations to the desired solution of an ill-posed problem depends essentially on the completeness of taking into consideration apriori information on that solution.

The accuracy of recovering characteristics from the inverse problem solution can essentially depend on the experiment design, in particular, measurement design. Therefore, of great importance is an optimal design of thermophysical experiments that is closely related to the method of inverse problem solution.

In view of the above said, the authors have tried to consider systematically the theoretical aspects of iterative regularization, to outline the ways of using this method in solution of applied problems, to present iterative algorithms for solving inverse heat transfer problems and the principles and algorithms for the design of thermophysical experiments.

Results given in the book were obtained by the authors. Section 1.6 was written by M. V. Klibanov, D.Sc.(Math) and the authors wish to express their gratitude to him. The structure and contents of the book can be inferred from the Contents List. Chapters 1 and 4 were written by O. M. Alifanov, Chapters 2, 3, and Appendix, by S. V. Rumyantsev, Chapters 5 and 6, by E. A. Artykhin.

Information for Readers. The following formula numbering system is adopted. The ordinal numbers of formulas, tables, and figures are given by the second digit. The first digit is the numbers of formulas refers to the Section number, in tables and figures it indicates the chapter number. The theorems and lemmas are numbered by one figure throughout each section, while referring to theorems and lemmas from another section, double numbering is used (the first figure refers to the section number where the theorem or lemma is presented).

CHAPTER

ONE

IDENTIFICATION AND INVERSE PROBLEMS IN STUDIES OF THERMOPHYSICAL PROCESSES

1.1 ON MATHEMATICAL MODELING OF PHYSICAL PROCESSES

Physical processes occurring in different media (gases, liquids, solids) are revealed by some effects recorded by special instruments. Leaning upon the observations (measurements) and general physical laws and relationships, one or another suitable mathematical model can be assigned to a process observed. The development and justification of mathematical models are often called *identification*.

A *mathematical model* (*MM*), as an abstract means for representing approximately a real process used for its study, is a mathematical description of essential factors and their interrelations. A set of models, differing specifically in the number of factors included and, consequently, in the description accuracy, on the one hand, and in complexity, on the other, can usually be assigned to the same process. The main requirement for *MM* is the necessity to take into account all major factors and interrelations for the process, neglecting the minor ones. The choice of a model primarily depends on the aim of the study. Moreover, the model should be simplified as much as possible for convenience of operation and for reduction of computation time.

Thus, in a general case the first step in the mathematical formulation of a problem is design of the model structure, i.e., the qualitative description of the process, using certain operators. This procedure is called *structural* identification.

Most often, the basis of mathematical models for physical processes constitute differential operators. There are models with *lumped parameters*, described by ordinary differential equations, and those with *distributed parameters*, employing partial differential equations. For physical processes, taking place in continuous media, signals (such as pressure, heat, concentration, electric current, etc.) are transferred through continuum of material points. In a general case, variables that characterize the state of processes are functions of both time and space. Such physical processes require partial differential equations for their description. However, more rough mathematical models based on ordinary differential equations can be used in some cases.

Models with lumped parameters ignore the spatial extent of the object studied or its elements. Naturally, such a description is possible if the transient processes in each element can be assumed independent of the space coordinates (the element dimensions are small compared to the least wavelength of the frequency components included the process). In this case spatial elements are modeled by material points, i.e., a more accurate model with distributed parameters is approximated by a model with lumped parameters.

Ordinary differential equations are used to describe the spatial motion of the center of solid mass, chemical kinetic processes, signal transmission in electrical circuits, and many others.

Partial differential equations are employed for the description of processes distributed in both time and space, the medium being not discrete but continuous in space. Such models are effective in the problems of air and gas dynamics, heat and mass transfer, elasticity, electrodynamics, etc.

The second step in the mathematical problem statement is determination of unknown characteristics (model parameters) included into the structural mathematical model. The step is called *parametric identification*.

The structural and parametric identifications of physical processes are closely connected with solution of *inverse problems for differential equations*. While formalizing general statements and dividing inverse problems into major classes, statements of direct problems are assumed to be known and each of them can be assigned, within the model under identification, to a set of inverse problems.

In what follows, physical processes will be examined on the cause-effect basis. In accordance with the model adopted, boundary conditions and their parameters, initial conditions, coefficients in differential equations and geometrical characteristics of the domain of assigning equations are *causal characteristics*. Then, *effect characteristics* will describe the object states which are generally meant as fields of physical quantities of particular nature.

Causal characteristics do not depend on the effect manifestations in the sense that the former can be specified independently of the latter by rather arbitrary quantities.

Two kinds of quantities are related to a unidirectional cause-effect dependence, and the aim of a *direct problem* is to establish this relation. If some causal characteristics are required to be recovered because of certain information on physical fields, we are to deal with an *inverse problem*.

Disturbance of the natural cause-effect relation that occurs in the statement of an inverse problem can lead to its mathematical ill-posedness, most often, to the solution instability. Therefore, inverse problems can be typical examples of ill-posed problems.

1.2 EXAMPLES OF INVERSE PROBLEM STATEMENTS

1.2.1 Systems with Lumped Parameters

Let the process studied be characterized by n relations in terms of the scalar argument t (process variables or coordinates) $y(t) = [y_n(t),...,y_n(t)]^T$ and according to a certain mathematical model, the vector satisfies the set of ordinary differential equations of the form

$$\frac{dy}{dt} = A(t)y + g(t), \quad y(0) = 0, \tag{2.1}$$

where,

$$g(t) = [g_1(t), ..., g_n(t)]^T,$$

$$A(t) = \begin{bmatrix} a_{11}(t) & \dots & a_{1n}(t) \\ \dots & \dots & \dots \\ a_{n1}(t) & \dots & a_{nn}(t) \end{bmatrix}.$$

The components of the vector $g(t)$ and the matrix $A(t)$ contain unknown quantities. They should be determined in terms of the known (say, measured) vector $z(t) =$ $= [z_1(t), ..., z_n(t)]^T$ $(l \leq n)$ linearly related to the vector $y(t)$:

$$z(t) = C(t)\, y(t)\,,$$

where $C(t)$ is a given matrix.

This inverse problem statement corresponds to identification of vector equation (2.1) with initial conditions known. The problem with matrix A and vector g being constant with time is a particular case.

The above inverse problem is used in many applications, for example, in studying *thermal conditions of engineering objects*. If the object is divided into n isothermal elements and heat is assumed to be transferred by conduction and convection, the heat balance equations written for each element compose the set

$$C_k \frac{dT_k}{d\tau} = \sum_{j=1}^{n} \lambda_{kj}\left(T_j - T_k\right) + S_k,\ k = \overline{1,n}, \quad \tau \in [0, \tau_m],$$

$$T_k(0) = T_{0k},\ k = \overline{1,n}, \tag{2.2}$$

where $T_k(\tau)$ is the temperature of the kth element; C_k is the heat capacity of the kth element; λ_{kj} is the thermal conductivity; S_k is the total heat flux released inside the kth

REFERENCES

1. Azarkevich, N. N., Uniqueness of Restoration of Initial Condition in the Boundary-Value Problems for Linear Parabolic Equations with a Splittable Operator. *In: Partial Differential Equations*. Kuibyshev Pedagogical Institute Press, Kuibyshev, 1983, pp. 139–146.
2. Alifanov, O. M., Zantsev, V. K., Pankratov, B. M. et al., *Algorithms for Diagnosis of Heat Fluxes in Flying Vehicles*. Ed. by V. P. Mishin. Mashinostroenie, Moscow, 1983, pp. 186–199.
3. Aldoshin, G. T., Golosov, A. S., Zhuk, V. I., Solution of Inverse Unsteady Heat Conduction Problem for a Plate. *In: Heat and Mass Transfer*. Nauka i Tekhnika, Minsk, 1968, vol. 8, pp. 186–199.
4. Alekseev, A. S., *Inverse Dynamic Seismic Problems. Particular Methods and Algorithms of Geophysical Interpretation*. Nauka, Moscow, 1967, pp. 9–84.
5. Alifanov, O. M., Regularization of Inverse Heat Conduction Problems. *In: Heat and Mass Transfer*. Nauka i Tekhnika, Minsk, 1972, vol. 8, pp. 89–98.
6. Alifanov, O. M., Iterative Solution of Inverse Heat Conduction Problem. *Inzhenerno-Fiz. Zhurn.*, 1974, vol. 26 (4), 682–689.
7. Alifanov, O. M., Inverse Heat Transfer Problems in Studying Thermal Processes and Designing Engineering Systems. *Inzhenerno-Fiz. Zhurn.*, 1977, vol. 33 (6), 972–981.
8. Alifanov, O. M., Determination of Heat Fluxes from Nonlinear Inverse Problem Solution, *Teplofiz. Vysok. Temperatur*, 1977, vol. 15 (3), 598–605.
9. Alifanov, O. M., *Identification of Heat Transfer Processes in Flying Vehicles. Introduction to the Theory of Inverse Heat Transfer Problems*. Mashinostroenie, Moscow, 1979, 216 pp.
10. Alifanov, O. M., Some Questions in Inverse Heat Conduction Problem Solution and Computer-Aided Data Processing in Thermophysical Studies. *Inzhenerno-Fiz. Zhurn.*, 1980, vol. 39 (2), 211–219.
11. Alifanov, O. M., Heat and Mass Transfer Identification with Inverse Problem Methods. *In: Modern Experimental Heat and Mass Transfer Methods. International Workshop*, pt. 2. A. V. Luikov Heat and Mass Transfer Inst., Minsk, 1981, pp. 133–147.
12. Alifanov, O. M., Ill-Posed Inverse Problem Solution Methods. *Inzhenerno-Fiz. Zhurn.*, 1983, vol. 45 (5), 742–752.

13. Alifanov, O. M., A Method for Including the *a priori* Information in Ill-Posed Inverse Problem Solution. *Inzhenerno-Fiz. Zhurn.*, 1985, vol. 49 (6), 925–932.

14. Alifanov, O. M., Artyukhin, E. A., Rumyantsev, S. V., Iterative Solution of Inverse Boundary and Coefficient Heat Condition Problems. *Heat and Mass Transfer, VI.* Heat and Mass Transfer Inst., Minsk, 1980, vol. 9, pp. 106–112.

15. Alifanov, O. M., Artyukhin, E. A., Tryanin, A. P., Determination of Heat Flux Density on a Porous Boundary from Inverse Problem Solution. *Teplofiz. Vysok. Temperatur*, 1983, vol. 21 (6), 1160–1168.

16. Alifanov, O. M., Balashova, I. E., Choice of Approximate Inverse Heat Conduction Problem Solution. *Inzhenerno-Fiz. Zhurn.*, 1985, vol. 48 (5), 851–860.

17. Alifanov, O. M., Gorshkov, M. I., Zantsev, V. K., Pankratov, B. M., Studies of Transient Solid-Plasma Jet Heat Transfer. *Inzhenerno-Fiz. Zhurn.*, 1975, vol. 29 (1), 26–36.

18. Alifanov, O. M., Egorov, Yu. V., Algorithms and Results of Inverse Two-Dimensional Boundary Heat Conduction Problem. *Inzhenerno-Fiz. Zhurn.*, 1985, vol. 48 (4), 658–668.

19. Alifanov, O. M., Kerov, N. V., Determination of External Heat Flux Parameters from Two-Dimensional Inverse Heat Conduction Problem. *Inzhenerno-Fiz. Zhurn.*, 1981, vol. 41 (4), 581–586.

20. Alifanov, O. M., Klibanov, M. V., Uniqueness Conditions and a Method of Inverse Coefficient Heat Conduction Problem Solution. *Inzhenerno-Fiz. Zhurn.*, 1985, vol. 48 (6), 998–1003.

21. Alifanov, O. M., Mikhailov, V. V., Determination of Heat Fluxes from Temperature Measurements in a Solid. *Teplofiz. Vysok. Temperatur*, 1983, vol. 21 (5), 944–951.

22. Alifanov, O. M., Mikhailov, V. V., Overdefined Inverse Heat Conduction Problem Solution with Inaccurate Data. *Teplofiz. Vysok. Temperatur*, 1985, vol. 23 (1), 120–125.

23. Alifanov, O. M., Nagoga, G. P., Sapozhnikov, V. M., The Problem on Determination of Internal Boundary Conditions in Measuring Thermal Characteristics of Cooled Gas Turbine Blades. *Inzhenerno-Fiz. Zhurn.*, 1986, vol. 51 (3), 403–409.

24. Alifanov, O. M., Rumyantsev, S. V., Stability of Iterative Methods of Linear Ill-Posed Problem Solution. *Dokl. AN SSSR*, 1979, vol. 248 (6), 1289–1291.

25. Alifanov, O. M., Rumyantsev, S. V., Regularizing Iterative Algorithms for Inverse Heat Conduction Problem Solution. *Inzhenerno-Fiz. Zhurn.*, 1980, vol. 39 (2), 253–258.

26. Alifanov, O. M., Tryanin, A. P., Unsteady-State Experimental Determination of Internal Heat Transfer Coefficient and Effective Thermal Conductivity of a Porous Body. *Inzhenerno-Fiz. Zhurn.*, 1985, vol. 48 (3), 472–483.

27. Amonov, B. K., A Particular Internal Problem for a Parabolic Equation. *Diff. Uravneniya*, 1984, vol. 20 (9), 1621–1623.

28. Anikonov, Yu. E., *Some Methods of Studying Multidimensional Inverse Problems for Differential Equations*. Nauka, Novosibirsk, 1978, 118 pp.

29. Arsenin, V. Yu., *Methods of Mathematical Physics and Special Functions*. Nauka, Moscow, 1974, 432 pp.

30. Artyukhin, E. A., Determination of Thermal Diffusivity from Experimental Data. *Inzhenerno-Fiz. Zhurn.*, 1975, vol. 29 (1), 87–90.

31. Artyukhin, E. A., Restoration of Heat Conduction Coefficients from Inverse Nonlinear Problem Solution. *Inzhenerno-Fiz. Zhurn.*, 1981, vol. 41 (4), 587–592.

32. Artyukhin, E. A., Restoration of Temperature Dependence of Thermal Conductivity from Inverse Problem Solution. *Teplofiz. Vysok. Temperatur*, 1981, vol. 19 (5), 963–967.

33. Artyukhin, E. A., Sensitivity Analysis and Experimental Design in the Problem on Generalized Heat Conduction Identification. *Heat and Mass Transfer VII*. Heat and Mass Transfer Institute, Minsk, 1984, vol. 7, pp. 81–84.

34. Artyukhin, E. A., Measurement Design for Inverse Coefficient Heat Conduction Problem Solution. *Inzhenerno-Fiz. Zhurn.*, 1985, vol. 48 (3), 490–495.

35. Artyukhin, E. A., Killikh, V. E., Okhapkin, A. S., Restoration of Effective Thermal Conductivity of Asbestous Textolyte from Inverse Problem Solution. *Inzhenerno-Fiz. Zhurn.*, 1983, vol. 45 (5), 788–794.

36. Artyukhin, E. A., Okhapkin, A. S., Restoration of Parameters in the Generalized Heat Conduction Equation from Unsteady Experimental Data. *Inzhenerno-Fiz. Zhurn.*, 1982, vol. 42 (6), 1013–1020.

37. Artyukhin, E. A., Okhapkin, A. S., Parametric Analysis of Solution Accuracy for Nonlinear Inverse Problem on Restoration of Thermal Conductivity of a Composite Material. *Inzhenerno-Fiz. Zhurn.*, 1980, vol. 39 (2), 259–263.

38. Artyukhin, E. A., Rumyantsev, S. V., The Gradient Method for Smooth Solutions of Inverse Boundary Heat Conduction Problems. *Inzhenerno-Fiz. Zhurn.*, 1980, vol. 39 (2), 259–263.

39. Artyukhin, E. A., Rumyantsev, S. V., Optimal Choice of Descent Steps in Gradient Methods of Inverse Heat Conduction Problem Solution. *Inzhenerno-Fiz. Zhurn.*, 1980, vol. 39 (2), 264–269.

40. Bakushinsky, A. B., Extension of the Residual Principle. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1970, vol. 10 (1), 210–214.

41. Bakushinsky, A. B., Solution Methods for Monotonic Variational Inequalities Based on Iterative Regularization Principle. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1977, vol. 17 (6), 1350–1362.

42. Bakushinsky, A. B., Strakhov, V. N., Successive Approximation Solution of Some Integral Equations of the First Kind. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1968, vol. 8 (1), 181–185.

43. Beznoshchenko, N. Ya., Determination of the Coefficients at Senior Derivatives in a Parabolic Equation. *Diff. Uravneniya*, 1975, vol. 11 (1), 19–26.

44. Beznoshchenko, N. Ya., On Solution Existence for the Problem on Determination of the Coefficient q in the Equation $u_t - \Delta u + qu = F$. *Diff. Uravneniya*, 1978, vol. 15 (1), 10–17.

45. Beznoshchenko, N. Ya., Nonuniqueness for the Problems on the Coefficients at Senior Terms in Partial Differential Equations. *Mat. Zametki*, 1984, vol. 36 (3), 305–308.

46. Bellman, R., Angel, E., *Dynamic Programming and Partial Differential Equations*. Mir Publ., Moscow, 1974, 207 pp.

47. Bers, L., John, F., Schechter, M., *Equations with Partial Derivatives*, Moscow, 1966, 351 pp.

48. Boyarinov, A. I., Kaferov, V. V., *Optimization Methods in Chemical Engineering*. Khimiya, Moscow, 1975, 351 pp.

49. Budak, B. M., Goldman, N. L., Uspensky, A. B., Difference Schemes with Straightening of the Fronts for Solving Multifront Problems of Stefan's Type. *In: Calculation Methods and Programming*. Moscow Univ. Press, Moscow, 1967, vol. 6, 206–216.

50. Bulychev, E. V., Glasko, V. B., Fedorov, S. M., Restoration of Initial Temperature from Surface Measurements. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1983, vol. 23 (6), 1410–1416.

51. But, E. N., Spline Identification of Heat Fluxes. *Inzhenerno-Fiz. Zhurn.*, 1977, vol. 33 (6), 1085–1089.

52. Butkovsky, A. G., *Characteristics of Systems with Distributed Parameters. Handbook*. Nauka, Moscow, 1979, 224 pp.

53. Buhgeim, A. L., Carleman Estimates for Wolterra Operators and Uniqueness of Inverse Problems. *In: Nonclassical Problems of Mathematical Physics.* Novosibirsk, 1981, 56–64.
54. Buhgeim, A. L., *Wolterra Equations and Inverse Problems.* Nauka, Novosibirsk, 1983, 205 pp.
55. Buhgeim, A. L., Multidimensional Inverse Problems. *In: Ill-Posed Problems of Mathematical Physics and Analysis.* Nauka, Novosibirsk, 1984, 31–35.
56. Vainikko, G. M., Error Estimates of Successive Approximations for Ill-Posed Problems. *Avtomatika i Telemekhanika,* 1980, No. 3, 84–92.
57. Vainikko, G. M., *Methods of Ill-Posed Linear Problem Solution in Hilbert Spaces.* Tartu Univ. Press, Tartu, 1982, 11 pp.
58. Vasiliev, F. P., *Numerical Methods of Extremum Problem Solution.* Nauka, Moscow, 1980, 520 pp.
59. Vasiliev, F. P., Yachimovich, M. D., Iterative Regularization of the Conditional Gradient Technique and the Newton Method with Inaccurately Presented Initial Data. *Dokl. AN SSSR,* 1980, vol. 250 (2), 265–269.
60. Vasiliev, F. P., *Methods of Extremum Problem Solution.* Nauka, Moscow, 1981, 521–524.
61. Veretennikov, A. Yu., Krasnoselsky, M. A., Regularization Stop Rules with Random Errors. *Dokl. AN SSSR,* 1983, vol. 268 (3), 521–524.
62. Vladimirov, V. S., *Equations of Mathematical Physics.* Nauka, Moscow, 1976, 527 pp.
63. Volkov, V. M., Inverse Problem for a Parabolic Quasilinear Equation. *In: Study of Inadequacy of Inverse Problems and Some Operator Equations.* Novosibirsk, 1981, 27–36.
64. Volkov, V. M., The Inverse Problem for a Parabolic Quasilinear Equation. *In: Ill-Posed Problems of Mathematical Physics and Analysis.* Nauka, Novosibirsk, 1984, 227–228.
65. Voskoboinikov, Yu. E., Preobrazhensky, N. G., Sedelnikov, A. I., *Mathematical Processing of Molecular Gas Dynamic Experiments.* Nauka, Novosibirsk, 1984, 240 pp.
66. Galkin, M. N., Boiko, A. N., Kharin, A. A., A Method for Internal Heat Transfer Boundary Condition Determination in Cooled Gas Turbine Blades. *Izv. VUZov,* Mashinostroenie, 1978, no. 8, 77–82.
67. Georgievsky, V. B., *Unified Algorithms for Determination of Filtration Parameters.* Naukova Dumka, Kiev, 1970, 328 pp.
68. Gilyazov, S. F., Iterative Methods for Solution of Linear Inconsistent Non-Self-Conjugated Operators. *Vestnik MGU. Ser. Vychislitelnaya Matematika i Kibernetika,* 1980, vol. 4 (3), 26–37.
69. Gilyazov, S. F., Stable Steepest Descent Solution of Linear Operator Equation of the First Kind. *Vestnik MGU. Ser. Vychislitelnaya Matematika i Kibernetika,* 1980, vol. 4 (3), 26–37.
70. Gilyazov, S. F., Nonlinear Regularization Conjugate Gradient Algorithm. *In: Methods and Algorithms in Numerical Analysis.* Moscow State Univ. Press, Moscow, 1984, 176–182.
71. Gilyazov, S. F., Kirsanova, N. N., A Particular Approach to Numerical Solution of Fredholm Integral Equation of the First Kind in the Class of Smooth Functions. *In: Methods and Algorithms in Numerical Analysis,* Ed. by V. A. Morozov. Moscow Univ. Press, Moscow, 1982, 34–47.
72. Glasko, V. B., *Inverse Problems of Mathematical Physics.* Moscow Univ. Press, 1984, 112 pp.
73. Golubev, G. V., Danilova, P. G., Tumashov, G. G., *Water Conductivity Determination of Inhomogeneous Oil Beds with Nonlocal Methods.* Kazan Univ. Press, Kazan, 1978, 167 pp.
74. Goncharsky, A. V., Leonov, A. S., Yagola, A. G., Some Generalization of the Residual Principle to the Operator Prescribed with an Error. *Dokl. AN SSSR,* 1972, vol. 203 (6), 1238–1239.
75. Goncharsky, A. V., Cherepashchuk, A. M., Yagola, A. G., *Numerical Methods for Astrophysical Inverse Problem Solutions.* Nauka, Moscow, 1978, 336 pp.

76. Gorsky, V. G., Adler, Yu. P., Talalay, A. M., *Industrial Experimental Design (Dynamics Models).* Metallurgia, Moscow, 1978, 112 pp.

77. Goryachev, A. A., Yudin, V. M., Solution of Inverse Coefficient Heat Conduction Problems. *Inzhenerno-Fiz. Zhurn.*, 1982, vol. 43 (4), 641–648.

78. Grebenshchikov, A. I., *The Spline Method and Solution of Ill-Posed Problems of the Approximation Theory.* Moscow Univ. Press, Moscow, 1983, 208 pp.

79. Gutenmacher, A. I., Timoshenko, Yu. A., Tikhonschuk, S. T., A Dynamic Method for Ill–Posed Problem Solution. *Dokl. AN SSSR*, 1977, vol. 237 (4), 776–778.

80. Denisov, A. M., Tuikina, S. R., Approximate Solution of an Inverse Sorption Dynamics Problem. *Vestnik MGU. Ser. Vychislitelnaya Matematika i Kibernetika*, 1983, no. 3, 27–31.

81. Denisov, A. M., Tuikina, S. R., Some Inverse Nonequilibrium Sorption Dynamics Problems. *Dokl. AN SSSR*, 1984, vol. 276 (1), 100–102.

82. Egorov, A. I., *Optimal Control of Thermal and Diffusion Processes.* Nauka, Moscow, 1978, 464 pp.

83. Emelin, I. V., Krasnoselsky, M. A., Stop Rule in the Iterative Procedures of Ill-Posed Problem Solution. *Avtomatika i Telemekhanika*, 1978, no. 2, 59–63.

84. Emelin, I. V., Krasnoselsky, M. A., A Contribution to the Theory of Ill-Posed Problems. *Dokl. AN SSSR*, 1979, vol. 244 (4), 805–808.

85. Zhuk, V. I., Golosov, A. S., Engineering Methods for Thermal Boundary Condition Determination from Temperature Measurements. *Inzhenerno-Fiz. Zhurn.*, 1975, vol. 29 (1), 45–50 .

86. Zamula, G. N., Yudin, V. M., Ill-Posed Heat Conduction and Radiation Problems. *Prikladnaya Mekhanika*, 1968, vol. 4 (1), 111–117.

87. Zantsev, V. K., Vishnevsky, G. E., Inverse Problem Diagnosis of High Temperature Material Test Regimes. *Inzhenerno-Fiz. Zhurn.*, 1983, vol. 45 (5), 721–726.

88. Zarubin, V. S., *Engineering Methods of Heat Conduction Problem Solution.* Energoatomizdat, Moscow, 1983, 328 pp.

89. Ivanov, V. K., An Approximate Solution of the First Kind Operator Equations. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1966, vol. 6 (6), 1089–1093.

90. Ivanov, V. K., Vasin, V. V., Tanina, V. P., *The Theory of Linear Ill-Posed Problems and Its Applications.* Nauka, Moscow, 1978, 206 pp.

91. Iskanderov, A. D., An Inverse Problem for Quasilinear Parabolic Equations. *Diff. Uravneniya*, 1974, vol. 10 (5), 890–898.

92. Ishamnazarov, B. I., The Relaxation Method of a Nonlinear Ill-Posed Problem Solution. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1978, vol. 18 (1), 3–9.

93. Kabanikhin, S. I., Solvability of Inverse Problems for Differential Equations. *Dokl. AN SSSR*, 1984, vol. 277 (4), 3–9.

94. Kamynin, L. I., Existence of Boundary-Value Problem Solution for a Parabolic Equation with Discontinuous Coefficients. *Izv. AN SSSR. Ser. Mat.*, 1964, vol. 28, 721–744.

95. Carry, D., WIlliams, S., Application of the Nonlinear Least Square Method to Thermal Property Determination. *J. Spacecrafts and Rockets*, 1973, vol. 11 (5), 118–124.

96. Carslow, W., Jeger, D., *Heat Conduction of Solids.* Nauka, Moscow, 1964, 487 pp.

97. Kartashov, E. M., *Analytical Methods in Heat Conduction of Solids.* Vysshaya Shkola, Moscow, 1979, 415 pp.

98. Kerov, N. V., Solution of a Two-Dimensional Inverse Heat Conduction Problem in Cylindrical Coordinate System. *Inzhenerno-Fiz. Zhurn.*, 1983, vol. 45 (5), 752–756.

99. Klibanov, M. V., Uniqueness "in a whole" of Some Multidimensional Inverse Problems. *In: Unconventional Problems of Mathematical Physics*. Novosibirsk, 1981, 101–114.

100. Klibanov, M. V., A Particular Class of Inverse Problems. *Dokl. AN SSSR*, 1982, vol. 256 (6), 1306–1309.

101. Klibanov, M. V., Inverse Problems "in a whole" and Carleman Estimates. *Diff. Uravneniya*, 1984, vol. 20 (6), 1035–1041.

102. Klibanov, M. V., Uniqueness of Inverse Problems "in a whole" for a Class of Differential Equations. *Diff. Uravneniya*, 1984, vol. 20 (11), 1947–1952.

103. Klibanov, M. V., A Particular Class of Inverse Problems for Nonlinear Parabolic Equations. *Dokl. AN SSSR*, 1985, vol. 280 (3), 533–536.

104. Klibanov, M. V., A Particular Class of Inverse Problems for Nonlinear Parabolic Equations. *Sibirsky Matem. Zhurn.*, 1986, vol. 27 (5), 83–94.

105. Kozdoba, L. A., *Solution of Nonlinear Heat Conduction Problems*. Naukova Dumka, Kiev, 1976, 136 pp.

106. Kozdoba, L. A., Krukovsky, P. G., *Methods of Inverse Heat Conduction Problem Solution*. Naukova Dumka, Kiev, 1982, 359 pp.

107. Kozdoba, L. A., Krivoshei, F. A., *Determination of Thermal Properties of Solids by Electrical Simulation of Inverse Unsteady Heat Conduction Problems*. Nauka, Moscow, 1973, 28–31.

108. Kolesnikov, P. M., Protodiakonova, T. G., Nonlinear Inverse Transfer Coefficient Problem. *Inzhenerno-Fiz. Zhurn.*, 1985, vol. 49 (6), 909–915.

109. Kollatz, L., *Functional Analysis and Computational Mathematics*. Mir Publ., Moscow, 1969, 447 pp.

110. Kochetov, I. I., A New Method for Regularization Parameter Choice. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1976, vol. 16 (2), 499–503.

111. Kryanev, A. V., Iterative Method for Ill-Posed Problem Solution. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1974, vol. 14 (1), 25–35.

112. Kuzmin, M. P., Lagun, I. M., Lagun, S. V., Inverse Heat Conduction Problem Solution on Analog Computers. *Inzhenerno-Fiz. Zhurn.*, 1977, vol. 33 (6), 1125–1130.

113. Labeish, V. G., *Liquid Cooling of High Temperature Metals*. Leningrad Univ. Press, Leningrad, 1983, 172 pp.

114. Lavrentiev, M. M., Cauchy Problem for Laplace Equation. *Izv. AN SSSR*, 1956, vol. 20, 819–842.

115. Lavrentiev, M. M., Qualitative Refinements of Internal Uniqueness Theorems. *Dokl. AN SSSR*, 1956, vol. 110 (5), 731–734.

116. Lavrentiev, M. M., *Some Ill-Posed Problems of Mathematical Physics*. Novosibirsk, 1962, 68 pp.

117. Lavrentiev, M. M., Romanov, V. G., Shishatsky, S. P., *Ill-Posed Problems of Mathematical Physics and Analysis*. Nauka, Moscow, 1980, 288 pp.

118. Lavrentiev, M. M., Some Questions of Analytical Extension from Internal Sets. *Sibirsky Matem. Zhurn.*, 1983, vol. 24 (5), 123–128.

119. Ladyzhenskaya, O. A., *Boundary-Value Problems of Mathematical Physics*. Nauka, Moscow, 1973, 736 pp.

120. Ladyzhenskaya, O. A., Solonnikov, V. A., Uraltseva, N. N., *Linear and Quasilinear Parabolic Equations*. Nauka, Moscow, 1967, 736 pp.

121. Landis, E. M., Some Problems of the Quantitative Theory of Elliptic and Parabolic Equations. *Uspekhi Mat. Nauk*, 1959, vol. 14 (1), 21–85.

122. Liskovets, O. A., *Variational Methods of Unstable Problem Solution.* Nauka i Tekhnika, Minsk, 1981, 343 pp.
123. Luikov, A. V., *Heat Conduction Theory.* Vysshaya Shkola, 1967, 599 pp.
124. Lyulka, A. M., Galkin, M. N., Vorontsov, A. V., Surov, N. S., *A Method for Control of Interior Cooling of Gas Turbine Blades.* Inventor's Certificate, no. 495958, 1974.
125. Makarov, A. M., Romanovsky, M. P., Solution of Inverse Coefficient Problems by Regularization with Spline Functions. *Inzhenerno-Fiz. Zhurn.*, 1978, vol. 34 (2), 332–337.
126. Marchuk, G. I., *Methods of Computational Mathematics.* Nauka, Moscow, 1980, 536 pp.
127. Marchuk, G. I., Ermakov, S. M., Some Problems of the Experimental Design Theory. *In: Mathematical Methods of Experimental Design.* Nauka, Novosibirsk, 1981, 3–18.
128. Panenko, V. V., Ed., *Mathematical Methods of Experimental Design.* Nauka, Novosibirsk, 1981, 256 pp.
129. Ermakov, S. M., Ed., *Mathematical Theory of Experimental Design.* Nauka, Moscow, 1983, 392 pp.
130. Matsevityi, Yu. M., *Electric Simulation of Nonlinear Problems of Engineering Physics.* Naukova Dumka, Kiev, 1977, 254 pp.
131. Matsevityi, Yu. M., Multanovsky, A. V., *Identification in the Heat Conduction Problems.* Naukova Dumka, Kiev, 1982, 240 pp.
132. Matsevityi, Yu. M., Multanovsky, A. V., Point-by-Point Identification of Thermal Properties. *Inzhenerno-Fiz. Zhurn.*, 1985, vol. 49 (6), 903–909.
133. Mikhailov, V. V., On Convergence of Iterative Methods for the Inverse Heat Conduction Problem Solution. *Inzhenerno-Fiz. Zhurn.*, 1983, vol. 45 (5), 770–773.
134. Mikhailov, V. P., *Partial Differential Equations.* Nauka, Moscow, 1976, 391 pp.
135. Mishin, V. P., Alifanov, O. M., Inverse Heat Transfer Problems: Applications in Design and Tests of Engineering Objects. *Inzhenerno-Fiz. Zhurn.*, 1982, vol. 42 (2), 181–182.
136. Mishin, V. P., Alifanov, O. M., *Improvement of the Development of High Heat Flux Structures and Inverse Heat Transfer Problems. I. General Theoretical Problems.* Mashinostroenie, 1986, no. 5, 19–29.
137. Mishin, V. P., Alifanov, O. M., *Improvement of the Development of High Heat Flux Structures and Inverse Heat Transfer Problems. II. Practical Applications.* Mashinostroenie, 1986, no. 6, 11–21.
138. Moiseev, N. N., Ivanilov, Yu. P., Stolyarova, E. M., *Optimization Methods.* Nauka, Moscow, 1978, 352 pp.
139. Morozov, V. A., Regularization Solution of the Functional Equations. *Dokl. AN SSSR*, 1966, vol. 167 (3), 510–512.
140. Morozov, V. A., Regularization Operator Families. *In: Computational Methods and Programming*, Moscow Univ. Press, 1967, 63–93.
141. Morozov, V. A., The Residue Principle in Regularization Solution of Operator Equations. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1968, vol. 8 (2), 295–309.
142. Morozov, V. A., *Regular Methods of Ill-Posed Problem Solution.* Moscow Univ. Press, Moscow, 1979, 359 pp.
143. Muzylev, N. V., Uniqueness Theorems for Some Inverse Heat Conduction Problems. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1980, vol. 20 (2), 388–400.
144. Muzylev, N. V., Uniqueness of Simultaneous Determination of Thermal Conductivity and Heat Capacity per Unit Volume. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1983, vol. 23 (1), 102–108.
145. M<129>ntz, G., *Integral Equations.* Pt. I. Gostekhizdat, Moscow, 1934, 330 pp.

146. Koshkin, V. K., Kalinin, E. K., Dreitser, G. A. et al., *Unsteady-State Heat Transfer*. Mashinostroenie, Moscow, 1973, 328 pp.
147. Nikitenko, N. I., *Network Study of Heat and Mass Transfer Processes*. Naukova Dumka, Kiev, 1978, 212 pp.
148. Nikitenko, N. I., Kolodnyi, Yu. M., Numeral Solution of Inverse Heat Conduction Problems on Determination of Thermal Properties. *Inzhenerno-Fiz. Zhurn.*, 1977, vol. 33 (6), 1958–1961.
149. Oganesyan, S. M., Starostenko, V. I., Statement Adequacy of Geophysical Problems Presented by Sets of Equations and Iterative Methods of their Solution. *Izv. AN SSSR. Fizika Zemli*, 1978, no. 8, 54–64.
150. Omelchenko, K. G., Savelov, M. V., Timoshenko, V. P., On the Study of Heat and Mass Transfer Processes in Decomposing Porous Materials. *Teplofiz. Vysok. Temperatur*, 1974, vol. 12 (4), 761–768.
151. Omelchenko, K. G., Volodina, M. V., Similarity Solution Analysis of Inverse Heat Conduction Problems. *Inzhenerno-Fiz. Zhurn.*, 1975, vol. 29 (1), 63–66.
152. Omelchenko, K. G., Pchelkina, V. G., Solution of Nonlinear Inverse Heat Conduction Problems on Determination of Thermal Properties. *Inzhenerno-Fiz. Zhurn.*, 1975, vol. 29 (1), 95–98.
153. Okhapkin, A. S., Studies of Heat Transfer Characteristics of Heat Protective Composites. *Inzhenerno-Fiz. Zhurn.*, 1985, vol. 49 (6), 989–994.
154. Pavlov, A. R., Permyakov, P. P., Stepanov, A. V., Determination of Thermal Properties of Freezing-Thawing Disperse Materials by Solving Inverse Heat Conduction Problems. *Inzhenerno-Fiz. Zhurn.*, 1980, vol. 39 (2), 292–297.
155. Pankratov, B. M., Polezhaev, Yu. V., Rudko,A. K., *Interaction between Materials and Gas Flows*. Mashinostroenie, Moscow, 1975, 224 pp.
156. Polak, E., *Numerical Optimization Methods. Unified Approach*. Mir Publ., Moscow, 1974, 374 pp.
157. Polezhaev, Yu. V., KIllikh, V. E., Narozhnyi, Yu. G., Problems of Unsteady Heating of Heat Protective Materials. *Inzhenerno-Fiz. Zhurn.*, 1975, vol. 29 (1), 39–44.
158. Polezhaev, Yu. V., Narozhnyi, Yu. G., Safonov, V. E., A Method for Determining Thermal Conductivity of High Temperature Materials under Unsteady Heating. *Teplofiz. Vysok. Temperatur*, 1973, vol. 11 (3), 609–615.
159. Polezhaev, Yu. V., Yurevich, F. B., *Heat Protection*. Energiya, Moscow, 1976, 392 pp.
160. Preobrazhensky, V. G., Pikalov, V. V., *Unstable Problems of Plasma Diagnosis*. Nauka, Novosibirsk, 1982, 237 pp.
161. Vainikko, G. M., Zabreiko, P. P. et al., *Approximate Solution of Operator Equations*. Nauka, Moscow, 1969, 455 pp.
162. Prilepko, A. I., Inverse Problems of Potential Theory. *Mat. Zametki*, 1973, vol. 14 (5), 755–765.
163. Prilepko, A. I., Ivankov, A. L., Inverse Problems for Unsteady-State Transfer Equation. *Dokl. AN SSSR*, 1984, vol. 276 (3), 555–559.
164. Prosuntsov, P. V., Reznik, S. V., Determination of Thermal Properties of Semitransparent Materials. *Inzhenerno-Fiz. Zhurn.*, 1985, vol. 49 (6), 977–982.
165. Pfahl, R., Mitchel, B., Nonlinear Regression Methods for Simultaneous Property Measurement., *J. Spacecraft and Rockets*, 1970, vol. 8 (6), 70–78
166. Pshenichnyi, B. N., Danilin, Yu. M., *Numeral Methods in Extremum Problems*. Nauka, Moscow, 1975, 319 pp.
167. Romanov, V. G., *Inverse Problems of Mathematical Physics*. Nauka, Moscow, 1984, 263 pp.
168. Romanovsky, M. R., Uniqueness of Inverse Coefficient Problem Solution for Linear Heat Conduction Equation. *Inzhenerno-Fiz. Zhurn.*, 1982, vol. 42 (3), 476–483.

169. Rumyantsev, S. V., *Regularization Gradient Algorithms and their Applications to the Problems on Physical Experimental Data Processing and Interpretation.* Cand. Eng. Thesis. Moscow Aviation Inst., 1981.
170. Rumyantsev, S. V., Methods of Including the *a priori* Information in Regularization Gradient Algorithms. *Inzhenerno-Fiz. Zhurn.*, 1985, vol. 49 (6), 932–936.
171. Ryazantseva, I. P., Successive Approximation Regularization of Equations with Accretive Operators. *Sibirsky Mat. Zhurn.*, 1978, vol. 21 (1), 223–226.
172. Samarsky, A. A., *The Theory of Difference Schemes.* Nauka, Moscow, 1977, 656 pp.
173. Samarsky, A. A., *Introduction into Numeral Methods.* Nauka, Moscow, 1982, 272 pp.
174. Sarv, L. E., A Class of Iterative Methods for Ill-Posed Self-Conjugated Problems in Hilbert Space. *Dokl. AN SSSR*, 1984, vol. 278 (5), 1066–1070.
175. Sarv, L. E., A Family of Nonlinear Iterative Methods for Ill-Posed Problem Solution. *Izv. AN ESSR. Fizika, Matematika*, 1982, vol. 31 (3), 261–269.
176. Senderevich, R. V., Pervushin, Yu. S., Determination of Thermal Properties Polymer Composite Materials. *Inzhenerno-Fiz. Zhurn.*, 1985, vol. 49 (6), 982–989.
177. Sergeev, V. L., Sergeeva, L. A., *Studies of Unsteady-State Heat Transfer in Plane and Axi-Symmetric Flows.* Preprint. Heat Mass Transfer Inst., Minsk, 1985, no. 5, 65 pp.
178. Simbirsky, D. F., Identifiability of Thermal Measuring Systems. *In: Experimental Methods for Thermal Strength of Gas Turbine Engines*, 1975, Issue 2, pp. 3–16.
179. Simbirsky, D. F., *Temperature Diagnosis of Engines.* Tekhnika, Kiev, 1976, 208 pp.
180. Smyshlyaeva, S. V., Yudin, V. M., Experimental Studies of Heat Resistance in Structural Joints. *Trans. Centr. Aerohydrodynam. Inst.*, 1971, vol. 2 (2), 66–72.
181. Stechkin, S. B., Subbotin, Yu. N., *Splines in Computing Mathematics.* Nauka, Moscow, 1976, 248 pp.
182. Strakhov, V. N., Successive Approximations for Linear Equations in the Hilbert Space. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1973, vol. 13 (4), 1041–1044.
183. Strakhov, V. N., On the Convergence Rate in Simple Iteration. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1973, vol. 13 (6), 1602–1606.
184. Strakhov, V. N., Valyashko, G. M., The Problem of Choosing a Regularization Parameter in Linear Ill-Posed Problem Solution. *Dokl. AN SSSR*, 1976, vol. 228 (1), 48–51.
185. Strakhov, V. N., Valyashko, G. M., The Regularization Method for Linear Ill-Posed Problems with *a priori* Information on the Properties of Input Disturbances. *Dokl. AN SSSR*, 1976, vol. 228 (2), 314–318.
186. Strakhov, V. L., Leonova, S. I., Gerashchenko, A. I., Some Results on Thermal Properties of Polymer Composite Materials as a Function of Temperature. *Inzhenerno-Fiz. Zhurn.*, 1977, vol. 33 (6), 1047–1051.
187. Tanina, V. P., *Methods of Operator Equation Solution.* Nauka, Moscow, 1981, 157 pp.
188. Gerashchenko, O. P., Gordov, A. N., Lakh, V. I. et al., *Temperature Measurements. Handbook*, Naukova Dumka, Kiev, 1984, 496 pp.
189. Tikhonov, A. N., Stability of Inverse Problems. *Dokl. AN SSSR*, 1943, vol. 39 (5), 195–198.
190. Tikhonov, A. N., Solution of Ill-Posed Problems and the Regularization Method. *Dokl. AN SSSR*, 1963, vol. 151 (3), 501–504.
191. Tikhonov, A. N., Regularization of Ill-Posed Problems. *Dokl. AN SSSR*, 1963, vol. 153 (1), 49–52.
192. Tikhonov, A. N., To Mathematical Justification of Electromagnetic Soundings. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1965, vol. 5 (3), 545–548.

193. Tikhonov, A. N., Arsenin, V. Ya., *Methods of Ill-Posed Problem Solution*. Nauka, Moscow, 1979, 288 pp.

194. Tikhonov, A. N., Glasko, V. B., Approximate Solution of Fredholm Integral Equations of the First Kind. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1964, vol. 4 (3), 564–571.

195. Tikhonov, A. N., Glasko, V. B., On the Methods of Surface Temperature Determination. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1967, vol. 7 (4), 910–914.

196. Tikhonov, A. N., Goncharsky, A. V., Stepanov, V. V., Yagola, A. G., *Regularization Algorithms and a priori Information*. Nauka, Moscow, 1983, 198 pp.

197. Tikhonov, A. N., Samarsky, A. A., *The Equations of Mathematical Physics*. Nauka, Moscow, 1972, 735 pp.

198. Trushnikov, V. P., Error Estimation of Approximate Solution Obtained with Nonlinear Regularization Algorithm. *Zhurn. Vychisl. Mat. i Mat. Fiz.*, 1982, vol. 22 (1), 227–331.

199. Uspensky, A. B., The Least Square Method in Inverse Heat Conduction Problems. *In: Solution of Optimal Control Problems and Ill-Posed Problems*. Moscow Univ. Press, Moscow, 1974, pp. 40–48.

200. Uspensky, A. B., Inverse Problems of Mathematical Physics. Experimental Analysis and Design. *In: Mathematical Methods of Experimental Design*. Nauka, Novosibirsk, 1981, pp. 199–242.

201. Uspensky, A. B., Fedorov, V. V., Experimental Design in Particular Inverse Problems of Mathematical Physics. *Kibernetika*, 1974, no. 4, 123–128.

202. Uspensky, A. B., Fedorov, V. V., *Computational Aspects of the Least Square Method in Analysis and Design of Regression Experiments*. Moscow Univ. Press, Moscow, 1975, 168 pp.

203. Faddeev, D. K., Faddeeva, V. N., *Computational Methods of Nonlinear Algebra*. Fizmatgiz. Moscow-Leningrad, 1963, 168 pp.

204. Fedorov, V. V., *The Theory of Optimal Experiments (Design of Regression Experiments)*. Nauka, Moscow, 1971, 312 pp.

205. Fedorov, V. V., Active Regression Experiments. *In: Mathematical Methods of Experimental Design*. Nauka, Novosibirsk, 1981, 19–73.

206. Friedman, A., *Parabolic Equations with Partial Derivatives*. Mir Publ., Moscow, 1968, 447 pp.

207. Friedman, V. M., Convergence of the Steepest Descent Method. *Uspekhi Mat. Nauk*, 1962, vol. 17 (3), 201–208.

208. Friedman, V. M., Successive Approximation Technique for the Fredholm Integral Equation of the First Kind. *Uspekhi Mat. Nauk*, 1956, vol. 11 (1), 233–234.

209. Frolov, V. V., Singularity Solution of the Problems on Heat Conduction Media Identification. *Dokl. AN BSSR*, 1973, vol. 17 (1), 25–28.

210. Hermander, L., *Linear Differential Operators with Partial Derivatives*. Mir Publ., Moscow, 1965, 379 pp.

211. Shashhov, A. G., *Systemic Structural Analysis of Heat Transfer Process and its Application*. Energoatomizdat, Moscow, 1983, 280 pp.

212. Shishatsky, S. P., *Uniqueness of Cauchy Problem for Degenerated Equations*. Novosibirsk, 1982, 126 pp.

213. Shishatsky, S. P., Extrapolation of Elliptic and Parabolic Equation Solution from Discrete Sets and Carleman Estimates with Distributed Singularities. *In: The Theory and Methods of Ill-Posed Problem Solution and Their Applications*. Novosibirsk, 1983, p. 128.

214. Shumakov, N. V., *The Successive Interval Method in Heat Measuring of Unsteady-State Processes*. Atomizdat, Moscow, 1979, 216 pp.

215. Yudin, V. M., Heat Propagation in Glass Plastics. *Trans. of Centr. Aerohydrodyn. Inst.*, no. 1267, TAGI Press, 1970, 41 pp,

216. Yankelev, L. F., Guseva, L.I ., A Method for Simultaneous Determination of Thermal Conductivity and Heat Capacity per Unit Volume Depending on Temperature. *Inzhenerno-Fiz. Zhurn.*, 1975, vol. 28 (4), 652–656.

217. Arima, R., On General Boundary Value Problem for Parabolic Equation. *J. Math. Kyoto Univ.*, 1964, vol. 4 (1), 207–244.

218. Aronszajn, N., A Unique Continuation Theorem for Solutions of Elliptic Partial Differential Equations or Inequalities of Second Order. *J. Math. Pures et Appl.*, 1957, vol. 9 (36), 235–249.

219. Beck, J. V., Nonlinear Estimation Applied to the Nonlinear Inverse Heat Conduction Problem. *Int. J. Heat and Mass Transfer*, 1970, vol. 13 (4), 703–716.

220. Beck, J. V., Arnold, K. I., *Parameter Estimation in Engineering and Science*. John Wiley and Sons, 1977.

221. Beck, J. V., Blackwell, B., St. Clair, C. R., Jr., *Inverse Heat Conduction. Ill-Posed Problems*. A Wiley-Interscience Publication, N.Y., 308 pp.

222. Carleman, T., Sur un probl<130>me d'unicite pour les systémes d'équations aux dérivées partielles á deux variables indépendantes. *Arkiv for Matematik, Astronomi och Fysik*, 1939, vol. 26 (17), 1–9.

223. Calderon, A. P., Uniqueness in the Cauchy Problem for Partial Differential Equations. *Am. J. Math.*, 1958, N 80, 16–36.

224. Cannon, J. R., Du Chatean, P., An Inverse Problem for an Unknown Source in a Heat Equation. *J. Math. Anal. and Appl.*, 1980, N 75, 465–485.

225. Cannon, J. R., Du Chatean, P., An Inverse Problem for a Nonlinear Diffusion Equation. *SIAM J. Appl. Math.*, 1980, vol. 39 (2), 272–289.

226. Chavent, G., Identification of Distributed Parameters. *In: Identification and System Parameter Estimation, Proc. 3d IFAC Symposium*, pt 2. North Holland Publ. Co., 1973, pp. 649–660.

227. Chavent, G., Identification of Distributed Parameters Systems: About the Output Least Square Method, its Implementation and Identifiability. *In: Identification and System Parameter Estimation, Proc. 5th IFAC Symposium*, vol. 1. Pergamon Press, 1980, pp. 85–97.

228. Kammerer, W. J., Nashed, M. Z., On the Convergence of the Conjugate Gradient Method for Singular Linear Operator Equations. *SIAM J. Numer. Anal.*, 1972, vol. 9 (1), 165–181.

229. Langford, D., New Analytic Solution of the One-Dimensional Equation for Temperature and Heat Flow Rate Both Prescribed at the Same Fixed Boundary. *Quart. Appl. Math.*, 1967, vol. 24 (4), 315–322.

230. Lorenzi, A., An Inverse Problem for a Semilinear Parabolic Equation. *Annali de Mat. Pura et Applicata*, 1982, vol. 31, 145–166.

231. Nashed, M. Z., Steepest Descent for Singular Linear Operator Equation. *SIAM J. Numer. Anal.*, 1970, vol. 7 (3), 358–362.

232. Protter, M. H., Properties of Solutions of Parabolic Equations and Inequalities. *Canad. J. Math.*, 1961, vol. 13, 331–345.

233. Qureshi, Z. N., Ng, T. S., Goodwin, G. C., Optimum Experimental Design for Identification of Distributed Systems. *Int. J. Control.*, 1980, vol. 31 (1), 21–29.

234. Tewarson, R. P., An Iterative Method for Computing Generalized Inverses. *Int. J. Comput. Math.*, 1971, vol. 3 (1), 65–74.

235. Vemuri, V., Chen Fang-pai, An Initial Value Method for Solving Fredholm Integral Equations of the First Kind. *J. Frank. Inst.*, 1974, vol. 297, 326–332.

236. Williams, S. D., Curry, D. M., An Analytical and Experimental Study for Surface Heat Flux Determination. *J. Spacecraft and Rockets*, 1977, vol. 14 (10), 632–637.
237. Cordes, H., Über die eindeutige Bestimmtheit der Lösungen elliptischer Differentialgleichungen durch Anfangsvorgaben. *Nachr. Akad. Wiss. Göttingen*, 1956, vol. 11, 239–258.
238. Mizohata, S., Unicité du prolongement des Solutions pour quelques operateurs différentiels parabuliques. *Mem. Coll. Sci. Univ. Kyoto. Ser. A*, 1958, vol. 31, 219–239.

SUPPLEMENT TO REFERENCES

1. Alifanov, O. M., "Diagnostics and Identification of Heat Exchange Processes". *In: "Heat and Mass Transfer-VII"*, Problem papers of VIIth All-Union Conference on Heat and Mass Transfer, part 2, Izd. ITMO Akad. Nauk BSSR, Minsk, 1985, pp. 117–127
2. Alifanov, O. M., "Derivation of Formulas for the Gradient of the Error in the Iterative Solution of Inverse Problems of Heat Conduction. I. Determination of the Gradient in Terms of the Green's Function", *J. Eng. Phys.*, 1987, vol. 52, No. 3, pp. 352–359.
3. Alifanov, O. M., "Extreme Methods in Heat Transfer Problems". *In: "Heat/Mass Transfer-MIF"*, Proceedings of the Minsk International Heat and Mass Transfer Forum, Minsk, May 24–27, 1988, Problem papers, Minsk, Izd. ITMO AN BSSR, Minsk, 1988
4. Alifanov, O. M., *"Inverse Heat Transfer Problems"*, International Series in Heat and Mass Transfer, Springer-Verlag, New York, Berlin, Heidelberg, 1994.
5. Alifanov, O. M., "Inverse Problems in the Design, Modeling and Testing of Engineering Systems". *In: Proceeding of the 3rd International Conference on Inverse Design Concepts and Optimiz. in Eng. Sci. (ICIDES-III)*, ed. G. S. Dulikravich, Washington, D. C., October 23–25, 1991.
6. Alifanov, O. M., Artyukhin, E. A., "Identification of Mathematical Models of Transient Heat Transfer Processes", *In: "Numerical Methods in Thermal Problems"*, Proc. 4th Int. Conf., Swansea, July 15–18, Swansea, 1985.
7. Alifanov, O. M., Artyukhin, E. A., Nenarokomov, A. V., "Spline Approximation of the Solution of the Inverse Heat-Conduction Problem, Taking Account of the Smoothness of the Desired Function", *High Temp.*, 1987, vol. 25, No. 4, pp. 520–526.
8. Alifanov, O. M., Artyukhin, E. A., Nenarokomov, A. V., *"Determination of Characteristics in Thermal Interaction of Materials with High-Enthalpy Gas Flow through Methods of Inverse Problems."* L. C. Wrobel, C. U. Brebbia, A. J. Nowak, eds. Advanced Computational Methods in Heat Transfer., Vol. 1., Proc. of the 1st International Conference (Portsmouth, UK, July 17–20, 1990) – Southampton: Computational Mechanics Publications. Berlin, Heidelberg: Springer-Verlag, 1990, pp. 323–332.
9. Alifanov, O. M., Artyukhin, E. A., and Rumyantsev S. V., *"Extremal Methods of Solving Ill-Posed Problems and their Application to Inverse Heat Transfer Problems"*, Nauka, Moscow, 1988, 288 p.
10. Alifanov, O. M., Artyukhin, E. A., Nenarokomov, A. V., *"Boundary Inverse Heat Conduction Problem in Parametric Form"*. K. A. Woodbury, ed. Proc. of 5th Annual Inverse Problems in Engineering Seminar (East Lansing, USA, June 11–12, 1992).-East Lansing: Michigan State University, 1992, 11 p.
11. Alifanov, O. M., Artyukhin, E. A., Nenarokomov, A. V., Repin, I. V., "The Evaluation of Parameters Determining the Heat Interaction of Materials with Two-Phase Flows by the Method of Inverse Problems", *High Temp.*, 1993, vol. 31, No. 3, pp. 407–411.
12. Alifanov, O. M., Balakovskii, S. L., Klibanov, M. V., "Reconstruction of Causal Characteristics of the Thermal Conductivity Process from Solution of the Combined Inverse Problem", *J. Eng. Phys.*, 1987, vol. 52, No. 5, pp. 617–622.
13. Alifanov, O. M., Balashova, I. E., "Solving Inverse Problems of Heat Transfer with Consideration of Data on the Smoothness of the Reconstructed Relation", *Izv. Sib. Otdel. Akad. Nauk SSSR, Ser Tech. Nauk*, 1987, vol. 7, No. 2, pp. 5–11.
14. Alifanov, O. M., Balashova, I. E., "Investigating the Diagnostics Algorithms of the Thermal Effect in Design", *J. Eng. Phys.*, 1989, vol. 56, No. 4, pp. 483–488.

15. Alifanov, O. M., Nagoga, G. P., Sapozhnikov, V. M., "Problem of Determining Internal Boundary Conditions in Measuring the Heat of Gas-Turbine Blades Undergoing Cooling", *J. Eng. Phys.*, 1986, vol. 51, No. 3, pp. 1040–1045.
16. Alifanov, O. M., Nenarokomov, A. V., "Effect of Different Factors on the Accuracy of the Solution of a Parameterized Inverse Problem of Heat Conduction", *J. Eng. Phys.*, 1989, vol. 56, No. 3, pp. 308–312.
17. Alifanov, O. M., Nenarokomov, A. V., "A Three-Dimensional Inverse Heat Conduction Problem in the Extremal Statement", *Dokl. Russian Akad. Nauk*, 1992, vol. 325, No. 5, pp. 950–954
18. Alifanov, O. M., Repin, I. V., "The Investigation of Heat Transfer in Heterogeneous Flows Using the Method of Inverse Problems of Thermal Conductivity", *High Temp.*, 1993, vol. 31, No. 1, pp. 71–75.
19. Alifanov, O. M., Rumyantsev, S. V., "Formulas for the Discrepancy Gradient in the Iterative Solution of Inverse Heat-Conduction Problems. II. Determining the Gradient in Terms of a Conjugate Variable", *J. Eng. Phys.*, 1987, vol. 52, No. 4, pp. 489–495.
20. Alifanov, O. M., Rumyantsev, S. V., "Gradient of the Discrepancy in the Iterative Solution of Inverse Heat-Conduction Problems. III. Calculation of the Gradient Using a Conjugate Boundary Problem", *J. Eng. Phys.*, 1987, vol. 52, No. 6, pp. 708–713.
21. Alifanov, O. M., Rumyantsev, S. V., "Application of Iterative Regularization for the Solution of Incorrect Inverse Problems", *J. Eng. Phys.*, 1987, vol. 53, No. 5, pp. 1335–1342.
22. Anger, G., "*Inverse Problems in Differential Equations*", Plenum Press, New York, 1990.
23. Artyukhin, E. A., "Optimum Planning of Experiments in the Identification of Heat-Transfer Processes", *J. Eng. Phys.*, 1989, vol. 56, No. 3, pp. 256–260.
24. Artyukhin, E. A., Baranov, V. V., Ganchev, B. G., Nenarokomov, A. V., "Nonsteady Heat-Transfer in the Wetting of Heated Surfaces", *High Temp.*, 1987, vol. 25, No. 5, pp. 719–723.
25. Artyukhin, E. A., Guseva, L. I., Tryanin, A. P., Shibin, A. G., "Data Processing and Planning of Nonstationary Thermophysical Experiments", *J. Eng. Phys.*, 1989, vol. 56, No. 3, pp. 286–290.
26. Artyukhin, E. A., Killikh, V. E., Nenarokomov, A. V., and Repin, I. V., "Investigation of the Thermal Interaction of Materials with Two-Phase Flows by the Inverse Problem Method", *High Temp.*, 1990, vol. 28, No. 1, pp. 94–99.
27. Artyukhin, E. A., Mamolov, V. A., Nenarokomov, A. V., "Evaluating the Effect of Shrinkage on the Effective Thermal Conductivity of a Glass-Reinforced Plastic", *J. Eng. Phys.*, 1989, vol. 56, No. 6, pp. 707–712.
28. Artyukhin, E. A., Nenarokomov, A. V., "Inverse Problem of Deriving the Integral Emissivity of a Solid", *High Temp.*, 1986, vol. 24, No. 5, pp. 725–729.
29. Artyukhin, E. A., Nenarokomov, A. V., "Coefficient Inverse Heat-Conduction Problem", *J. Eng. Phys.*, 1987, vol. 53, No. 3, pp. 1085–1090.
30. Atkinson, A. C., "Optimum Experimental Design for Parameter Estimation and for Discrimination between Models in the Presence of Prior Information". V. V. Fedorov, W. G. Muller, I. N. Vuchkov, eds. Model Oriented Data-Analysis. *Proc. of the 2nd IIASA-Workshop* (St. Kyrik, Bulgaria, 1990). – Heidelberg: Physica-Verlag, 1990, pp. 3–30.
31. Balakovskii, S. L., "Resolving Power of the Iteration Method of Solving Inverse Heat Conduction Boundary Value Problems", *J. Eng. Phys.*, 1987, vol. 52, No. 6, pp. 713–717.
32. Balakovskii, S. L., "Solution of Inverse Heat Transfer Problems by a Two-Model Method", *J. Eng. Phys.*, 1990, vol. 57, No. 3, pp. 1118–1122.
33. Balk, P. I., "Practically Achievable Accuracy and Reliability of the Solution of Inverse Heat Conduction Problems", *J. Eng. Phys.*, 1987, vol. 52, No. 2, pp. 243–249.
34. Banks, H. T., Kunish, K., "*Estimation Techniques for Distributed Parameter Systems*", Birkhauser, Boston, 1989, 315 p.
35. Banks, H. T., Rosen, I. G., "Numerical Schemes for the Estimation of Functional Parameters in Distributed Models for Mixing Mechanisms in Lake and Sea Sediment Cores", *Inverse Problems*, 1987, vol. 3, pp. 1–23.
36. Barber, D. C., Brown, B. H., "Progress in Electrical Impedance Tomography", D. Colton, R. Ewing, W. Rundell, eds., Inverse Problems in Partial Differential Equations, *Proc. of SIAM Conference*,

(Humboldt State University, Arcata, California, July 29– August 4, 1989), Philadelphia: SIAM, 1990, pp. 151–164.

37. Baumeister, J., "*Stable Solution of Inverse Problems*", Vieweg & Sohn, Braunschweig/Wiesbaden, 1987.
38. Baumeister, J. and Reinhardt, H. J., "Inverse Heat Conduction Problems and their Numerical Solution". *In: "Inverse and Ill-Posed Problems"*, H. W. Engl, C. W. Groetsch, eds., Academic Press, 1987, pp. 325–344.
39. Beck, J. V., "Combined Parameter and Function Estimation in Heat Transfer with Application to Contact Conductance", Trans. ASME, *Journal of Heat Transfer*, 1988, vol. 110, pp. 1046–1058.
40. Ben-Haim, Y. and Elias E., "Indirect Measurements of Surface Temperature and Heat Flux: Optimal Design Using Convexity Analysis", *International J. of Heat and Mass Transfer*, 1987, vol. 30, No. 8, pp. 1673–1683.
41. Blackwell, B. F., "Numerical Prediction of One-Dimensional Ablation Using a Finite Control Volume Procedure with Exponential Differencing", *Numerical Heat Transfer*, 1988, vol. 14, pp. 17–34.
42. Budnik, S. A., Guseva, L. T., Shibin, A. G., "Analysis of the Method of Temperature Measurements Used to Determine the Set of Characteristics of a Thermally Protective Coatings", *J. Eng. Phys.*, 1989, vol. 56, No. 3, pp. 301–308.
43. Cannon, J. R., Chateau, P., "Determination of Unknown Coefficients in Parabolic Operator from Overspecified Initial-Boundary Data", Trans. ASME, *Journal of Heat Transfer*, 1989, vol. 100, pp. 503–507.
44. Cannon, J., Hornung U., Eds., "*Inverse Problems*", Birkhauser, Basel, 1986.
45. Carasso, A. S., "Impulse Response Acquisition as an Inverse Heat Conduction Problem", *SIAM J. Appl. Math.*, 1990, vol. 50, No. 1, pp. 75–90.
46. Carasso, A. S., "Corrigendum: Impulse Response Acquisition as an Inverse Heat Conduction Problem", *SIAM J. Appl. Math.*, 1990, vol. 50, No. 3, pp. 942.
47. Carasso, A. S., "Space Marching Difference Schemes in the Nonlinear Inverse Heat Conduction Problem", *Inverse Problems*, 1992, vol. 8, pp. 25–43.
48. Chavent, G. "A Geometrical Approach for the a priori Study of Non-Linear Inverse Problem", P. C. Sabatier, ed., *Inverse Problems: an Interdisciplinary Study*, London, Orlando, San Diego, New York, Austin, Boston, Sydney, Tokyo, Toronto: Academic Press, 1987, pp. 511–522.
49. Chavent, G. "Identifiability of Parameters in the Output Least Square Formulation, E. Walter, ed., *Identifiability of Parametric Model*, Oxford, New York, Beijing, Frankfurt, San Paulo, Sydney, Tokyo, Toronto,: Pergamon Press, 1987, pp. 67–74.
50. Courvile, G. E., Beck, J. V. "Techniques for in situ Determination of Thermal Resistance of Lightweight Board Insulations, Trans. ASME, *Journal of Heat Transfer*, 1989, vol. 111, pp. 274–280.
51. Chen, H. and Chang, S., "Application of the Hybrid Method to Inverse Heat Conduction Problems", *International J. of Heat and Mass Transfer*, 1990, vol. 33, No. 4, pp. 621–628.
52. Denisov, V. N., "Stabilization of the Solution of the Cauchy Problem for the Heat Equation", *Soviet Math. Dokl.*, 1988, vol. 37, No. 3, pp. 688–692.
53. El Bagdouri, M., Jarny, Y., "Optimal Boundary Control of a Thermal System : an Inverse Conduction Problem", H. E. Rauch, ed., *Proc. of the 4th IFAC Symp. on Control of Distributed Parameter Systems* (Los Angeles, USA, 1986), Oxford, New York, Beijing, Frankfurt, San Paulo, Sydney, Tokyo, Toronto: Pergamon Press, 1987, pp. 389–393.
54. Elden, L., "Hyperbolic Approximations for a Cauchy Problem for the Heat Equation", *Inverse Problems*, 1988, 4, pp. 59–70.
55. Engl, H. W. and Groetsch, C. W., Eds., "*Inverse and Ill-posed Problems*", Academic Press, Orlando, 1987.
56. Engl, H., Lanthaler, T., and Manselly, P., "On an Inverse Problem for a Nonlinear Heat Equation Connected with Continuous Casting of Steel". *In: "Optimal Control with Partial Differential Equations II*", K-H. Hoffmann, W. Krabs, eds., Birkhauser, Basel, 1987, pp. 67–89.
57. Engl, H. and Manselli, P., "Stability Estimates and Regularization for an Inverse Heat Conduction Problem", *Numer. Func. Anal. Optim. 10*, 1989, pp. 517–540.

58. Fedorov, V. V., "Various Constraints in Experimental Design", V. V. Fedorov, W. G. Muller, I. N. Vuchkov, eds., Model Oriented Data-Analysis, *Proc. of the 2nd IIASA-Workshop* (St. Kyrik, Bulgaria, 1990), Heidelberg: Physica-Verlag, 1990, pp. 39–51.
59. Flach, G. P. and Ozisik, M. N., "Whole Domain Function - Specification Method for Linear Inverse Heat Conduction", *Annals of Nuclear Energy*, 1986, vol. 13, No. 6, pp. 325–336.
60. Flach, G. P. and Ozisik, M. N., "Inverse Heat Conduction of Periodically Contacting Surfaces", *Trans. ASME, Journal of Heat Transfer*, 1988, vol. 110, No. 4, pp. 821–829.
61. Flach, G. P. and Ozisik, M. N., "Inverse Heat Conduction Problem of Simultaneously Estimating Spatially Varying Thermal Conductivity and Heat Capacity per Unit Volume", *Numerical Heat Transfer*, 1989, vol. 16, No. 2, pp. 249–266.
62. Flach, G. P., Ozisik, M. N., "An Adaptive Inverse Heat Conduction Method with Automatic Control", *Trans. ASME, Journal of Heat Transfer*, 1992, vol. 114, pp. 5–13.
63. Friedman, A., Reitich F., "Parameter Identification in Reaction-Diffusion Models", *Inverse Problems*, 1992, vol. 8, pp. 187–192.
64. Gentili, G., "Dissipativity Condition and Inverse Problems for Heat Conduction with Linear Memory", *Inverse Problems*, 1991, vol. 7, No. 1, pp. 77–84.
65. Gillian, D. S., Mair, B. A., and Martin, C. F., "An Inverse Convolution Method for Regular Parabolic Equations", *SIAM J. Control Optim.*, 1991, vol. 29, No. 1, pp. 71–88.
66. Gillian, D. S., Mair, B. A., and Martin, C. F., "A Convolution Method for Inverse Heat Conduction Problems", *Math. Systems Theory*, 1988, vol. 21, No. 1, pp. 49–60.
67. Godfrey, K. R., Di Stefano III, J. J., "Identifiability of Model Parameters", E. Walter, ed., *Identifiability of Parametric Model*, Oxford, New York, Beijing, Frankfurt, San Paulo, Sydney, Tokyo, Toronto: Pergamon Press, 1987, pp. 1–20.
68. Haario, H., ed., "*Theory and Applications of Inverse Problems*", New York,: Wiley, 1988, 159 p.
69. Hadaegh, F. Y., Bekey, G. A., "Identifiability of Systems with Modeling Error - a New Formulation", E. Walter, ed., *Identifiability of Parametric Model*, Oxford, New York, Beijing, Frankfurt, San Paulo, Sydney, Tokyo, Toronto: Pergamon Press, 1987, pp. 92–96.
70. Hensel, E., "*Inverse Theory and Applications for Engineers*", Prentice Hall, Englewood Cliffs, New Jersey, 1991, 396 p.
71. Hensel, E., Hills, R., "Steady-State Two-Dimensional Inverse Heat Conduction", *Numerical Heat Transfer*, Part B, 1989, vol. 15, pp. 227–240.
72. Ho, C.-H., Ozisik, M. N., "An Inverse Radiation Problem", *Int. Journal Heat and Mass Transfer*, 1989, vol. 32, No. 2, pp. 335–341.
73. Hodge, J. K., Chen, A. J., "Unsteady Heat Transfer Coefficient Estimation for Long Duration", *Journal of Thermophysics and Heat Transfer*, 1988, vol. 2, No. 3, pp. 218–226.
74. Hsu, N.-S., Yeh, W. W.-G., "Optimum Experiment Design for Parameter Identification in Groundwater Hydrology", *Water Resources Research*, 1989, vol. 25, No. 5, pp. 1025–1040.
75. Huang, C. H., Ozisic, M. N., "Inverse Problem of Determining Unknown Wall Heat Flux in Laminar Flow through a Parallel Plate Duct", *Numerical Heat Transfer*, Part A, 1992, vol. 21, pp. 55–70.
76. Isakov, V., "*Inverse Source Problems*", Providence, USA: Amer. Math. Soc., 1992, 193 p.
77. Jarny, Y., Ozisik, M. N., and Bardon, J. P., "General Optimization Method Using Adjoin Equation for Solving Multidimensional Inverse Heat Conduction", *International J. of Heat and Mass Transfer*, 1991, vol. 34, No. 11, pp. 2911–2919.
78. Kamumoto, K., Iwamoto, M., "Inversion Method for Determining Effective Thermal Conductivity of Porous Materials", *Trans. ASME, Journal of Heat Transfer*, 1987, vol. 109, pp. 831–834.
79. Kurpisz, K., "Method for Determining Steady State Temperature Distribution within Blast Furnace Hearth Lining by Measuring Temperature at Selected Points", *Transactions of the Iron and Steel Institute of Japan*, 1988, vol. 28, No. 11, pp. 926–929 (in Japanese).
80. Kurpisz, K., "Numerical Solution of One Case of Inverse Heat Conduction Problems", *Trans. ASME, Journal of Heat Transfer*, 1991, vol. 113, No. 2, pp. 280–286.
81. Li, H. Y., Ozisic, M. N., "Identification of the Temperature Profile in an Absorbing, Emitting and Isotropically Scattering Medium by Inverse Analysis", *Trans. ASME, Journal of Heat Transfer*, 1992, vol. 114, pp. 1060–1063.

82. Liu, G. L., "A Novel Variational Formulation of Inverse Problem of Heat Conduction with Free Boundary on an Image Plane", *Numerical Methods in Thermal Problems*, 1989, vol. VI, Parts 1, 2, Pineridge, Swansea, pp. 1712–1720.
83. Ljuing, L., "*System Identification: Theory for the User*", Englewood Cliffs, New Jersey, USA: Prentice-Hall, 1987, 519 p.
84. Maillet, D., Deliovanni, A., and Pasquetti, R., "Inverse Heat Conduction Applied to the Measurement of Heat Transfer Coefficient on a Cylinder. Comparison between an Analytical and a Boundary Element Technique", *Trans. of ASME, Journal of Heat Transfer*, 1991, vol. 113, No. 3, pp. 549–557.
85. Markin, A. D. and Pyatyshkin, G. G., "Regularization of the Solution of the Inverse Heat Conduction Problem in a Variational Formulation", *J. Eng. Phys.*, 1987, vol. 52, No. 6, pp. 717–721.
86. Marquardt, W. and Auracher, H., "An Observer-Based Solution of Inverse Heat Conduction Problems", *International J. of Heat and Mass Transfer*, 1990, vol. 33, No. 7, pp. 1545–1562.
87. McCormick, N. J., "Inverse Radiative Transfer Problems: a Review", *Nuclear Science and Engineering*, 1992, vol. 112, pp. 185–198.
88. Mehta, R. C., "Deforming Grid Method Applied to the Inverse Problem of Heat Conduction", *Journal of Thermophysics and Heat Transfer*, 1989, vol. 3, No. 2, pp. 225–228.
89. Meric, R. A., "Sensitivity Analysis and Optimization for Joule Heating with Temperature-Dependent Conductivities", *Numerical Heat Transfer*, Part B, 1989, vol. 16, pp. 213–229.
90. Mishin, V. P., Alifanov, O. M., "Quality Improvement in Final Design of Thermally Stressed Structures, and Inverse Heat-Transfer Problems. 1. General Problems of the Theory", *Soviet Machine Science*, 1986, No. 5, pp. 16–25.
91. Mishin, V. P., Alifanov, O. M., "Improving Final Designs of Thermally Stressed Structures, and Inverse Heat-Transfer Problems. 2. Practical Applications", *Soviet Machine Science*, 1986, No. 6, pp. 8–16.
92. Miyauchi, H., Sagara, S., Maeda, M. et al. , "Estimation of Unknown Nonlinear Boundary Condition in Parabolic Distributed Parameter System", T. Futagami, S. G. Tzafestas, Y. Sunahara, eds., *Proc. of the IMACS/IFAC Int. Symp. on Modeling and Simulation of Distributed Parameter System* (Hiroshima, Japan, 1987), Amsterdam, Oxford, New York, Tokyo: North-Holland, 1989, pp. 495–500.
93. Montgomery, D. C., "*Design and Analysis of Experiments*", New York, Chichester, Brisbane, Toronto, Singapore: John Wiley & Sons, 1991, 649 p.
94. Mukherjee, S., Zabaras, N., Richmond, O., "An Analysis of Inverse Heat Transfer Problems with Phase Changes Using an Integral Method", *Trans. ASME, Journal of Heat Transfer*, 1988, vol. 110, No. 3, pp. 554–561.
95. Murio, D. A., "Parameter Selection by Discrete Mollification and the Numerical Solution of the Inverse Heat Conduction Problem", *J. Comp. Appl. Math.*, 1988, vol. 22, pp. 25–34.
96. Murio, D. A., "The Mollification Method and the Numerical Solution of the Inverse Heat Conduction Problem by Finite Differences", *Computers Math. Applic.*, 1989, vol. 17, No. 10, pp. 1385–1396.
97. Murio, D. A. and Guo, L., "A Stable Marching Finite Difference Algorithm for the Inverse Heat Conduction Problem with no Initial Filtering Procedure", *Computers Math. Applic.*, 1990, vol. 19, No. 10, pp. 35–50.
98. Nacagiri, S., "Identifiability of Coefficient Matrices, Time Delays and Initial Functions of Functional Differential Equation", M. Yamaguti, K. Hayakawa, Y. Iso et al., eds., *Inverse Problems in Engineering Sciences, Proc. of a Conference* (Osaka, Japan, August 19–20, 1990), Tokyo, Berlin, Heidelberg, New York, London, Paris, Hong Kong, Barcelona: Springer Verlag, 1981, pp. 106–112.
99. Nashed, M. Z., "*Ill-Posed Problems: Theory and Practice*", 1987.
100. Nashed, M. Z., "On Nonlinear Ill-Posed Problems 1: Classes of Operator Equations and Minimization of Functionals". *In: "Nonlinear Analysis and Applications"*, V. Lakshmikantham, ed., Dekker, New York, 1987, pp. 351–373.
101. Nenarokomov, A. V., "Parameter Estimation in the Heat Transfer Model on Surfaces and Interfaces", O. M. Alifanov, J. V. Beck, eds., *Final Report. Joint American-Russian NSF Workshop on Inverse*

Problems in Heat Transfer (East Lansing, USA, 13–15 June 1992), East Lansing: Michigan State University, 1992, pp. B.6.1 – B.6.25.

102. Ohnaka, K., "Identification of the External Force of Wave Equations from Noisy Observations", M. Yamaguti, K. Hayakawa, Y. Iso et al., eds., *Inverse Problems in Engineering Sciences, Proc. of a Conference* (Osaka, Japan, August 19–20, 1990), Tokyo, Berlin, Heidelberg, New York, London, Paris, Hong Kong, Barcelona: Springer-Verlag, 1981, pp. 66–72.
103. Omatu, S., Seinfeld, J. H., "Optimal Sensor and Actuator Locations for Linear Distributed Parameter Systems, H. E. Rauch, ed., *Proc. of the 4th IFAC Symp. on Control of Distributed Parameter Systems* (Los Angeles, USA, 1986), Oxford, New York, Beijing, Frankfurt, San Paulo, Sydney, Tokyo, Toronto: Pergamon Press, 1987, pp. 215–220.
104. Osman, A. M., Beck, J. V., "Experimental Investigation of Time-and-Space Dependent Heat Transfer Coefficients in Quenching", K. T. Yang, ed., *Collected Papers in Heat Transfer*, Part 1, 1988, pp. 39–46 (ASME HTO vol. 104).
105. Osman, A. M., Beck, J. V., "Nonlinear Inverse Problem for the Estimation of Time-and-Space Dependent Heat-Transfer Coefficient", *Journal of Thermophysics and Heat Transfer*, 1989, vol. 3, No. 2, pp. 146–152.
106. Perng, M.-H., "Effective Approach for the Identification of Boundary Conditions in Distributed-Parameter Systems", *Int. J. Control*, 1987, vol. 45, No. 2, pp. 607–616.
107. Pilant, M. S., Rundell, W., "Undetermined Coefficient Problems for Quasilinear Parabolic Equations", D. Colton, R. Ewing, W. Rundell, eds., Inverse Problems in Partial Differential Equations, *Proc. of SIAM Conference* (Humboldt State University, Arcata, California, July 29 – August 4, 1989), Philadelphia: SIAM, 1990. pp. 165–185.
108. Pronzato, L., Walter, E., "Experiment Design in a Bounded-Error Context: Comparison with D-Optimality", *Automatica*, 1989, vol. 25, pp. 383–391.
109. Palancz, B., and Szabolcz, G., "Solution of Inverse Heat Conduction Problem by Orthogonal Collocation Techniques", *Acts Technica*, Budapest, 1988, vol. 101, No. 3, pp. 323–337.
110. Prosuntsov, P. V., Reznik, S. V., "Problems of Heat Transfer in Semitransparent Scattering Materials. 1. The Theoretical Fundamentals of the Absolute Stationary Method for Determination of Thermal Conductivity", *Sib. Fiz.-Tekhn. Zh.* (Izv. Sib. Otd. Russ. Akad. Nauk), 1991, Issue 1, pp. 51–56
111. Prosuntsov, P. V., Reznik, S. V., Tyutyunnik V. E., "Problems of Heat Transfer in semitransparent scattering materials. 2. The experimental facility and results of investigating thermal conductivity by the absolute stationary Method", *Sib. Fiz.-Tekhn. Zh.* (Izv. Sib. Otd. Russ. Akad. Nauk), 1992, Issue 4, pp. 27–32
112. Prosuntsov, P. V., Reznik, S. V., "Problems of Heat Transfer in Semitransparent Scattering Materials. 3. The Theoretical Fundamentals of Determination of Thermal Conductivity by the Method of Monotonous Heating", *Sib. Fiz.-Tekhn. Zh.* (Izv. Sib. Otd. Russ. Akad. Nauk), 1992, Issue 4, pp. 33–38
113. Ramm, A. G., "*Multidimensional Inverse Scattering Problems*", New York,: John Wiley, 1992, 380 p.
114. Raynaud, M., "Comparison of Space Marching Finite Difference Technique and Function Minimization Technique for the Estimation of the Front Location in Nonlinear Melting Problems", *Fifth Symposium on Control of Distributed Parameter Systems*, A. El Jai and M. Amoroux, eds., Universite de Perpignan, France, 1989, pp. 215–220.
115. Raynaud, M. and Beck, J. V., "Methodology for Comparison of Inverse Heat Conduction Methods", *Trans. of the ASME, Journal of Heat Transfer*, 1988, vol. 110, pp. 30–37.
116. Reinhardt, H. J., "Numerical Method for the Solution of Two-Dimensional Inverse Heat Conduction Problem", *International J. for Numerical Methods in Engineering*, 1991, vol. 32, No. 2, pp. 363–383.
117. Reinhardt, H. J. and Valensia, L., "The Numerical Solution of Inverse Heat Conduction Problems with Application to Reactor Technology". *In: "Structural Mechanics in Reactor Technology"* (9th SMLPL-Conf., Lausanne), 1987, Ed. F. H. Wittmann, vol. B, pp. 25–29.
118. Romanov, V. G., "*Inverse Problems of Mathematical Physics*", Utrecht, The Netherlands: VNU Science Press, 1987, 239 p.

119. Roy, D. N., "*Methods of Inverse Problems in Physics*", Boca Raton, Ann Arbor, Boston: CRC Press, 1991, 498 p.
120. Sabatier, P. C., ed., "Basic Method of Tomography and Inverse Problem", Bristol, Philadelphia: Adam Hilger, 1987, 671 p.
121. Sabatier, P. C., Chadan, K., "*Inverse Problems in Quantum Scattering Theory*", New York, Berlin, Heidelberg, London, Paris, Tokyo: Springer-Verlag, 1989, 439 p.
122. Scott, E. P. and Beck, J. V., "Analysis of Order of the Sequential Regularization Solutions of Inverse Heat Conduction Problems", *Trans. ASME, Journal of Heat Transfer*, 1989, vol. 111, No. 2, pp. 218–224.
123. Scott, E. P., Beck, J. V., Heldman, D. R., "Estimation of Transient Heat Transfer Coefficient in Frozen Fooddoring Storage", K. T. Yang, ed., *Collected Papers in Heat Transfer*, Part 1, 1988, pp. 55–61 (ASME HTD, vol. 104).
124. Shoji, M. and Ono, N., "Application of the Boundary Element to the Inverse Problem of Heat Conduction", *Nippon Kikai Gakkai Ronbunshu*, B Hen, 1988, vol. 54, No. 506, pp. 2893–2900 (in Japanese).
125. Sun, X. and Jaggard, D. L., "The Inverse Black Body Radiation Problem: a Regularized Solution", *Journal of Applied Physics*, 1987, vol. 62, No. 11, pp. 4382–4386.
126. Silva Neto, A. J., Ozisik, M. N., "An Inverse Analysis of Simultaneously Estimation Phase Function, Albedo and Optical Thickness", S. T. Thynell, M. F. Modest, L. C. Burmeister et al., eds., *Developments in Radiative Heat Transfer*, 1992, pp. 23–30 (ASME HTD, vol. 203).
127. Talenti, G., ed., "*Inverse Problems*", LNM 1225, Springer-Verlag, New York, 1986.
128. Taler, J., "Nonlinear Steady-State Inverse Heat Conduction Problem with Space-Variable Boundary Conditions, *Trans. ASME, Journal of Heat Transfer*, 1992, vol. 114, pp. 1048–1051.
129. Tandy, D. F., Trujillo, D. M., and Busby, H. R., "Solution of Inverse Heat Conduction Problems Using an Eigenvalue Reduction Technique", *Numerical Heat Transfer*, 1986, vol. 10, No. 6, pp. 597–617.
130. Tarantola, A., "*Inverse Problem Theory. Methods for Data Fitting and Model Parameter Estimation*", Amsterdam, Oxford, New York, Tokyo: Elsevier, 1987, 624 p.
131. Tervola, P., "A Method to Determine the Thermal Conductivity from Measured Temperature Profiles", *Int. Journal of Heat and Mass Transfer*, 1989, vol. 32, No. 8, pp. 1425–1430.
132. Tikhonov, A. N., Goncharsky, A. V., eds, "*Ill-Posed Problems in the Natural Sciences*", MIR, Moscow, 1989.
133. Trujillo, D. M., Busby H. R., "Optimal Regularization of the Inverse Heat-Conduction Problem", *Journal of Thermophysics and Heat Transfer*, 1989, vol. 3, No. 4, pp. 423–427.
134. Walter, E., Pronzato, L., "Qualitative and Quantitative Experiment Design for Phenomenological Models. A survey", *Automatica*, 1990, vol. 26, No. 2, pp. 195–213.
135. Weiland, E. and Babary, J. P., "Comparative Study for a New Solution to the Inverse Heat Conduction Problem", *Comm. in Applied Numerical Methods*, 1988, vol. 4, No. 5, pp. 687–689.
136. Woodbury, K., "Effect of Thermocouple Sensor Dynamics on Surface Heat Predictions Obtained Via Inverse Heat Transfer Analysis", *International J. of Heat and Mass Transfer*, 1990, vol. 33, No. 12, pp. 2641–2649.
137. Woodbury, K. A., "Determination of Surface Heat Fluxes During Spray Quenching of Aluminum Using an Inverse Technique", *ASME Paper* No. 91–WA–HT–12, Winter Annual Meeting, 1991, Atlanta, Georgia.
138. Zabaras, N., "Inverse Finite Element Techniques for the Analysis of Solidification Processes", *International J. for Numerical Methods in Engineering*, 1990, vol. 29, No. 7, pp. 1569–1587.
139. Zabaras, N. and Liu, J. C., "An Analysis of Two-Dimensional Linear Inverse Heat Transfer Problems Using an Integral Method", *Numer. Heat Transfer*, 1990, vol. 13, pp. 527–533.
140. Zabaras, N., Mukherjee, S., and Richmond, D., "An Analysis of Inverse Heat Transfer Problems with Phase Changes Using an Integral Method", *Trans. ASME, Journal of Heat Transfer*, 1988, vol. 110, pp. 554–561.
141. Zabaras, N., Ruan Y., "A Deforming Finite Element Method Analysis of Inverse Stefan Problems", *Int. J. for Numerical Methods in Engineering*, 1989, vol. 28, pp. 295–313.