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INTERNATIONAL CONFERENCE "IDENTIFICATION OF DYNAMIC SYSTEMS AND INVERSE PROBLEMS OF HEAT TRANSFER"

O.M.Alifanov

Seminars and conferences on inverse problems of heat transfer and identification have been regular events in the Soviet Union starting from 1974, when the first All-Union Seminar was organized at the Moscow Aviation Institute. In all, six similar scientific meetings took place in Moscow (1974, 1976, 1979, 1982), Ufa (1984), and Yaropolts in the Moscow Region (1987).

The 1st International Conference on these problems was held on September 10-14, 1990 in the town of Suzdal' in the Moscow Region. The total number of participants at the Conference was 105, and the number of reports heard was 99.

The present issue of the Inzhenerno-Fizicheskii Zhurnal contains a collection of reports and communications discussed at the Conference and recommended by the Conference Organizing Committee for publication.

As a new and promising direction of research, methods based on the solution of inverse heat transfer problems have been in rapid and intense development starting from the first formulations and approaches around 1960 to a rather soundly based theory and numerous practical applications in different fields of science and technology at the present time. Today we have actually come right up to the creation of scientifically justified principles underlying the development of mathematical models and the diagnostics of heat transfer processes on the basis of a fundamental unity between theory and experiment. This is, perhaps, the principal result of the thrusts of many investigations carried out in the field in different countries. Speaking at the Conference, well-known American specialist on the solution of inverse heat conduction problems and estimation of the parameters Professor at the University of Michigan J. Beck noted a new paradigm of revolutionary investigations that open up the prospects for studying substantially more complex phenomena than those amenable to treatment by ordinary techniques. In his publications the present author invariably directed the attention of research workers to this wide class of problems as a very promising one that opens new possibilities for investigations of the phenomena of heat and mass transfer and design of heat-loaded technical objects and technological processes.

It is well known that the reliability and accuracy of experimental and theoretical investigations into processes of heat and mass transfer, design and testing of thermally loaded structures and systems, and development of different technological operations associated with heating or cooling of objects depend directly on the justifiability of the mathematical models used for solving the corresponding problems of analysis and synthesis. Mathematical simulation includes examination of external effects on the considered system or process, isolation of the significant characteristics of the system and variables of the state, and establishment of connections between them. On a large scale, mathematical simulation is the sequence of operations such as the development and substantiation of mathematical models, the construction of computing schemes, algorithms, and programs for solving direct problems, and, finally, the calculation of the states of the object investigated. It does not always happen that investigators devote their efforts to these operations in proportion to the contribution of the latter to the accuracy of the final results. It has turned out historically that the theory and methodology of the first stage (of the development and substantiation of mathematical models) were developed much more slowly than the theory and methodology of the other two. In the long run, we are able to efficiently solve diverse boundary-value problems for different types of ordinary differential and partial differential equations, including nonlinear and multidimensional. These, of course, are very significant scientific achievements. However, one should not also forget

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about the special importance of the first stage of simulation, since the solutions of direct problems can involve large errors, already unremovable at these stages, because the selected mathematical models are not very adequate to real processes. The more so that very often, but far from always justifiably, simple models, linear and one-dimensional, that do not take into account the conjugation of heat transfer processes etc. are used in practice. It may happen under these conditions that all subsequent efforts to increase the accuracy of calculations turn out to be simply inefficient.

Inverse problems as a tool of diagnostics and identification of physical processes are principally intended for correctly and justifiably selecting mathematical models and providing them with reliable quantitative information, having eliminated as far as possible the intuitive-heuristic approach. Investigations of recent years have shown that this can be done most efficiently by combining the methodology of inverse problems with the optimal planning of the corresponding experiments and tests. These problems were discussed in detail at the International Conference in Suzdal' and received partial treatment in this issue of the journal.

In June 1992 in East Lansing, Michigan, an American-Russian Workshop was held on methods of inverse problems in studies of heat transfer processes. French and Czechoslovak specialists also participated in the meeting. The meeting was regarded as a continuation of the discussions of diverse problems associated with the solution of incorrectly stated inverse problems and with the practical application of the corresponding methods that had been initiated at the International Conference in Suzdal'. In particular, a decision was reached about the advisability of convening regular international seminars and conferences on these topics.

The second international conference on inverse problems and identification of the heat transfer process is planned to be held on August 22-26, 1994 in St. Petersburg. The address of the Organizing Committee is: Moscow Aviation Institute, Department 601, Volokolamsk Shosse 4, Moscow, 125871. Telephone: (095) 158-47-56; fax (095) 229-32-37; telex: 411746 Sokol SU.