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BOOK REVIEWS

A. A. MIKHALEVICH, **The Mathematical Modelling of Condensation Heat and Mass Transfer**. Nauka i Technika, Minsk, 1982, 216 pp.

THIS monograph presents film condensation heat and mass transfer based on the phenomenological theory of transfer processes. The book contains the following seven chapters:

1. Condensation on Vertical Surfaces.
2. Condensation in a Horizontal Tube.
3. Data Processing and Generalization of the Numerical and Experimental Results.
4. Two-dimensional Condensation in a Vertical Tube.
5. Two-dimensional Analysis of Heat and Mass Transfer for In-tube Condensation.
6. One-dimensional In-tube Condensation.
7. Condensation Heat Transfer in Tube Bundles.

Appendix: Computer Codes of Condensation Heat and Mass Transfer.

Starting with condensation of a chemically reacting gas mixture in the presence of reversible chemical reactions between the condensing and non-condensing components a number of special cases have been derived and considered; a numerical study of the problems mentioned has been performed and some practical recommendations together with the corresponding FORTRAN codes have been presented.

It is shown that the dependence of the heat flux on the temperature difference is not linear and therefore the classical heat transfer coefficient is not always applicable. But instead of rejecting totally the classical concepts of the convective heat transfer coefficient (as is done in the *New Heat Transfer* by E. Adiutori) the author has correctly considered mathematical models with or without this coefficient.

The models are classified into four groups:

(a) models of conjugated partial differential equations describing the transfer processes in the boundary layer approximation;

(b) one-dimensional models describing the longitudinal distribution of the averaged cross-section flow characteristics;

(c) boundary layer flow models using suction on the surface of a rigid wall;

(d) models based on the Nusselt film approximation.

The simplifying assumption used in the formulation of the models has been discussed in detail.

The presentation of the text is clear and the only critical remark could be found in the insufficient comments in the codes. It is a pity that the results presented in this book are available only to Russian speaking readers.

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S. S. KUTATELADZE, **Similarity Analysis in Thermal Physics**. Izd. Nauka, Novosibirsk, 1982, 280 pp., 144 illust., 6 tables, 131 lit. refs.

IT IS hardly too much to say that a fruitful scientific work in the field of thermophysics is impossible without an extensive use of the methods of similarity and dimensional theories. Though the number of papers on the subject were not lacking, a monograph was required which would have generalized the use of these methods in thermal physics from a singular point of view. So, it can be said that the monograph has been written in consequence of the recognition of scientific community requirements. On the other hand, the keen interest of Academician S. S. Kutateladze in the similarity theory methods has long been known—he has made a considerable contribution to both the theory of the method and its application to thermal physics. The results of his many years devotion to the field have been summarized in the present monograph.

The content of the monograph may be subdivided into four quite natural parts. The first part presents the fundamentals of the dimensional and similarity analysis. The second part concerns itself with the analysis of the similarity theory application to homogeneous media. It deals with the similarity numbers of conduction heat transfer and the criterion of the hydro- and gasdynamic similarity. Using the analysis of a boundary layer at large Reynolds numbers as an example, the author demonstrates here the 'technology' of application of the similarity theory methods in the study of complex thermophysical processes. The problems associated with the concept of a model medium, with the study of the asymptotic properties of the transport process and of the medium and the arising relations between the dimensionless groups, with the consistence and correction of the results obtained are considered in detail. The third part of the monograph is concerned with the application of the similarity theory to the study of heterogeneous media: gas–liquid, dispersed systems with phase transitions. The contribution of Kutateladze to the study of these systems is extremely important. He has identified, in particular, a great number of similarity criteria for such media, with one of these bearing his name.

Part 4 discusses the problems associated with the use of the similarity theory in the study of wall turbulence, radiative heat transfer, magnetohydrodynamics (in particular, the similarity numbers of a plasmatron), thermophysical properties of substances (including those near the critical point). Kutateladze gives convincing evidence that the similarity and dimensional analysis can give most fruitful results when used in conjunction with the study of the phenomenon dynamics, if only in its elementary form, and vice versa. Unfortunately, this is often forgotten by many of the research workers, especially young ones.

A separate chapter is devoted to the use of the similarity analysis in the modelling of thermophysical processes. The main problems of physical modelling are discussed. With the aid of two examples, the modelling of thermal power engineering equipment is considered in detail. The presentation of the material in the monograph is quite accessible to a design engineer and, methodologically, can serve as a model for advanced research and development. It is desirable that in future editions of the monograph this practically important part be somewhat extended by including the examples of modelling thermophysical processes in heterogeneous media.

Kutateladze writes in his book: "...with all seeming simplicity of the dimensional and similarity analysis fundamentals, their effective use is rather an art". We are sure that an attentive reader, having got acquainted with the book, will see that the author is himself a master of this art and can teach both an engineer and a research worker to use the similarity analysis skillfully with much success in their practical work.

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