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BOOK REVIEWS

Heat Transfer

J. P. Holman

The first edition of this elementary treatment of the principles of heat transfer was published in 1963; that the author has made strenuous efforts to keep it up to date is demonstrated by the appearance of successive editions at intervals not exceeding five years. One of the stated objectives of this fifth edition is to include recent information about analytical techniques and experimental data while still retaining a simple approach which can be understood by the student at junior grade level or above. It is, however, difficult to accept the implication that with this additional information the material can still be adequately covered in a one-semester course.

The sections on numerical solutions to multidimensional and unsteady-state conduction problems have been expanded. New and useful examples have been added illustrating treatments of radiation and non-linear convection boundary conditions, variable properties, non-uniform nodal spacings, composite materials and iterative-solution techniques for sets of non-linear equations.

The chapters on forced and free convection have been updated in regard to empirical correlations, though the treatment of high-speed flow is more restricted than might have been expected; moreover, the attention given to turbulence, usually in terms of fluid instability, the time-averaged equations and Reynolds stresses, seems quite inadequate for a proper understanding of the complex processes of convection unless the student has some familiarity with fluid mechanics. Thus I find myself in disagreement with the author's contention that such familiarity is not essential to a fruitful study of his book.

Some new examples using both the network and matrix solution techniques are introduced in the chapter on radiation heat transfer. These include iterative solutions for non-linear problems involving both convection and radiation, as in the topical case of a solar heat collector. It is disappointing to find that the additions to the chapter on condensation and boiling pay so little attention to the effects of non-condensable gases on condensation, and particularly to the long-standing measurements of Hampson and Ozesek[1], and that Kutataladze's[2] criterion for the peak heat flux in nucleate pool boiling is ignored, the more so since it also readily covers subcooled boiling.

Additional analytical expressions for heat-exchanger performance parameters are coupled with a new section on compact heat exchangers. This might well have included those incorporating heat pipes, one of the special topics discussed in a later chapter, and though updated, still without reference to the dimensionless wick properties and liquid transport factors which help to determine performance, or to the capillary and boiling restrictions and the sonic limitation on mass flow. Particularly welcome are the new examples to illustrate energy storage systems and variable-property analysis in a simple heat exchanger.

Emphasis in the numerical-solution sections has been placed on problem formulation rather than on specific computer programs to solve heat transfer problems. In so choosing, the author is to be commended in anticipating the use of desk-top minicomputers which are likely to be highly individualistic in their programming and input-output facilities. From the student's point of view it is unfortunate that the problems at the ends of the chapters, which have been increased by over 100 in this fifth edition, are without answers. While this is common practice in the United States, it is hardly calculated to increase sales of this rather expensive book overseas, particularly in the United Kingdom, when there are other texts which do so. Although the material is generally well presented, it is debatable whether the additions in this updated edition are always those best suited to current undergraduate needs.

B. W. Martin

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Published, price £21.75 net, by McGraw Hill

Fluid Transients and Structural Interactions in Piping Systems

P. H. Rothe and D. C. Wiggert (Eds)

One of the outstanding fields facing technologists today is the acoustic and hydrodynamic coupling between a fluid and an elastic structure. This subject is not new, having reared its usually ugly head in many branches of engineering, and it probably received its most thorough attention in aeronautics under the title of 'aeroelasticity'. In recent years it has again become of concern, to nuclear engineers, particularly in the context of postulated accidents involving breached pressure vessels, as well as water-hammer phenomena. The subject has always been plagued by extraordinarily complex mathematics. Unfortunately, it has also been plagued by preconceptions originating in researchers' experiences in the prediction of vibrations of structures *in vacuo*, and it appears that few acknowledge the fact that, sometimes, the displacements of a fluid-loaded structure cannot be decomposed into sets of orthogonal modes.

This publication presents, in the editors' words, examples of contemporary work in this field. It is not a book, but rather a small volume containing six papers presented at a symposium in Colorado during June 1981; as such, it is not aimed at newcomers to this field, but at the designer or researcher in the nuclear or chemical industry who already possesses some knowledge of the subject.

Of the six papers, three in fact describe uncoupled phenomena in which the influence of structural motion on the fluid is ignored. Two of these are based on RELAP4 computations of two-phase blowdown transients associated with check valve closure, and they delineate topics for potential improvement in a subject which is difficult enough without the added complication of structural motion. It is noteworthy that wide use is made of an estimate of wave speed which is in fact the low-frequency limit for the dispersive medium, and one cannot help wondering whether this is appropriate during rapid transients. The third paper presents a general technique for determining the acoustic characteristics of bridge networks, compares theory with experiment, and then proceeds to predict the behaviour of a meter station on the Alaskan gas pipeline.

The remaining three papers do address structural motion. The first two recommend techniques which can be used in conjunction with existing structural computer codes, thereby facilitating relatively easy simulations of fluid-structure interactions. It is, however, vital for the reader to understand precisely which physical effects are accounted for, and this is not always clarified by the authors. The first paper is based on the notion that the fluid-structure coupling is weak and is therefore only suitable in those circumstances where the structural response time is much larger than the characteristic time scale of the imposed transient. Predictions are given of the response of a line containing two elbows to a single pressure pulse. The second paper presents a useful literature survey, a promising technique and encouraging comparisons with experiments. It does note the departure of resonance frequencies from the vacuum values, but it is based on a modal synthesis which again hinges on the classical concepts. The third of these papers presents the data from an experiment on the response of a U-shaped pipe to water-hammer. Comparison with theory indicates that the system behaviour may be explained on the basis of simple, uncoupled dynamics.

Overall, while I do not regard this publication as a major contribution to the fundamental study of fluid-structure interactions, it certainly constitutes a useful reference for those who have to answer pressing questions in contemporary engineering.

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Books received

Two-phase flow and heat transfer in the power and process industries, *Bergles, Collier, Delhaye, Hewitt and Mayinger*, $55.00, Hemisphere Publishing Corporation

Basic mechanisms in two-phase flow and heat transfer, *ed. P. H. Rothe and R. T. Lakey*, $28.00 (ASME members $14.00), pp 129, American Society of Mechanical Engineers

Fluid mechanics of combustion systems, *ed. Morel, Lohmann and Rackley*, $40.00 (ASME members $20.00), American Society of Mechanical Engineers

Centrifugal pump clinic, *I. J. Karassik, SFr* 118.00, Marcel Dekker AG

Process level instrumentation and control, *N. P. Cheremisinoff*, SFr 89.00, Marcel Dekker AG

Inclusion of a publication in this section does not necessarily preclude subsequent review