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Book Reviews

Handbook of Heat and Mass Transfer, Volumes One and Two, ed., N. P. Cheremisinoff, Gulf Publishing Company.

The notion of reviewing an engineering handbook has never been appealing to me. This reviewer has always felt that in most engineering handbooks the material content is too compressed and with poor emphasis on fundamentals. They are usually useful if you want to relearn a forgotten topic, or to understand the operation of an engineering device, or to look up equations and physical properties necessary in design calculations. It has been a very delightful surprise to find out that the *Handbook of Heat and Mass Transfer* does not fit that notion. The main thrust of this new engineering handbook is the understanding of the fundamentals of transport phenomena. The editor states in the preface that the handbook is aimed at unifying heat and mass transport concepts for the practicing engineer. I believe that the editor has accomplished his goal and more. The editor has enlisted the services of more than one hundred specialists in the field of heat and mass transfer. These specialists have done an excellent job in presenting heat and mass transfer in a manner easy to follow by a stranger to the field and pleasant to read by anyone familiar with the subject. Every chapter opens with an introduction from which the reader obtains a clear picture of the chapter content and concludes with an extensive bibliography. The treatment in each chapter is comprehensive, with minimum redundancy, with hardly an overlap between chapters, indicating a superb editing effort.

The work is divided into two volumes. Volume 1: *Heat Transfer Operations*, contains two sections. The first section, "Heat Transfer Mechanisms," devotes twenty chapters to discussions of principles and applications of transport phenomena. The reader is guided through fundamental and interesting topics such as heat flux in the Benard-Rayleigh problem, natural convection in evaporating droplets, heat flux measurements, forced-convection boiling in uniformly heated channels, etc. In addition, several chapters are devoted to more recent areas of research. The second section, "Industrial Operations and Design," provides 23 chapters on critical unit operations involving heat exchangers, drying operations, combustion, and heat transfer problems in specialized reactors. Volume 2: *Mass Transfer and Reactor Design* emphasizes multi-component mass transfer in nine chapters. Section II, "Distillation and Extraction," contains eight chapters with emphasis given to design-related problems. Section III, "Multiphase Reactor Systems," devotes 15 chapters to various types of reactors of industrial importance. Section IV, "Special Applications and Reactor Topics," provides five chapters on the subjects of industry crystallization, thermal diffusion columns, parametric pumping, and some other special topics of interest.

Overall, the handbook is well written, it covers a wealth of material, and is well produced. I strongly recommend the handbook to anyone working in heat and mass transfer.

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Handbook of Hydraulic Resistance, 2nd Edition, by I. E. Idelchik, Hemisphere Publishing Corp., New York, 1986.

The present edition of the *Handbook of Hydraulic Resistance*, translated into English from the second Russian edition of the book (Mashinostroenie Publishing House, Moscow, 1975), differs markedly from its first edition (Gosenergoizdat, Moscow, 1960), translated into English in 1966 (*Handbook of Hydraulic Resistance*, Israel Program for Scientific Translation, Jerusalem, 1966), and into French in 1969 (*Memento des pertes de charge*, Eyrolles Editeur, Paris, 1969).

The second edition of the book has been substantially augmented by incorporating a considerable body of totally new data on hydraulic resistances obtained as a result of research work in recent years. By and large, as compared with the first, the second edition contains more than 40 percent new and revised data.

When this edition was prepared, all of the misprints and errors discovered in the Russian edition were corrected, and some more precise definitions and changes were made.

The book is based on the utilization, systematization, and classification of the results of a large number of studies carried out and published at different times in different countries. A large portion of the data was obtained by the author as a result of investigations carried out by him.

It is quite clear that the methods of investigation, the models used, and, consequently, the accuracy of the results obtained and reported by various authors differ markedly in many cases. Such differences in the results could also be due to the fact that the majority of local hydraulic resistance coefficients are greatly influenced not only by the regime of flow, but also by the prehistory of the flow; that is, conditions of supply to the section considered, nature of the velocity profiles, and degree of turbulence at the inlet, and in some cases of the subsequent history of the flow as well, i.e., flow removal from the test section.

Many complex elements of pipelines exhibit great instability of flow due to periodic fluid separation form the walls, periodic changes of place and magnitude of separation, and eddy formation resulting in large oscillations of hydraulic resistance.

The author was faced with an enormously difficult task: to discover and, where necessary, discard experimental results of questionable validity in that diverse body of data compiled on the hydraulic resistance coefficients; to clear up cases where large variations in the resistance coefficients of the sections are regular and correspond to the essence of the hydrodynamic pattern and those cases where they are due to the experimental uncertainty; and to select the most reliable data and find a successful format for presenting the material so that it is accessible and understandable to nonspecialists in aerodynamics and hydraulics. It had to be taken into account that, in practice, the configurations of sections of and impedances in pipelines, their geometric parameters, the conditions of entry and exit of the flows, and its regimes are so diverse that it is not always possible to find the required reported experimental data necessary to calculate the hydraulic resistances. The author has therefore incorporated in this handbook not only results that have been thoroughly verified in laboratories, but also those provided by less rigorous experimental investigations and those predicted or obtained by approximate calculations based on separate experiment studies. In some cases tentative data are shown and are so noted in the text. We think this approach is justifed because the facilities used under industrial conditions, and consequently the conditions of flow passages in them, can greatly differ among themselves and differ from laboratory conditions, under which the majority of hydraulic resistance coefficients have been obtained. In many complex elements of pipelines, these coefficients, cannot be constant due to the nature of the phenomena occurring in them; thus, they can vary over wide ranges.

I. E. Idelchik
(from Author's Preface)

Aerothermodynamics of Low Pressure Steam Turbines and Condensers, eds., M. J. Moore and C. H. Sieverding, Hemisphere Publishing Corp., New York, 1987.

In the field of large-scale power generation, the steam turbine occupies a central position whether the energy source is a fossil-fueled boiler, a gas-cooled nuclear reactor, a light or heavy water reactor, a fast reactor, or, looking ahead, even a nuclear fusion reactor. The high cost of fossil fuels, however, and the high capital cost of nuclear systems makes it increasingly important to convert the liberated heat-energy to mechanical power as efficiently as possible. This volume describes key developments in the quest for higher turbine efficiency.

The 1970s saw the expansion of turbine size, reaching unit outputs of up to 1300 MW. In contrast, the downturn in world economic growth in the 1980s has resulted in a sharp reduction in orders for new machines and many utilities are taking steps to extend the operating life of older turbines. An essential element of the life extension exercise is the retrofitting of new components, using the lastest design theories, to improve efficiency. Such schemes have been found highly cost-beneficial.

Prime candidates for retrofitting are the low-pressure turbine and condenser where, as unit sizes have increased, the aerothermodynamic design problems have been more difficult than in other parts of the machine. For these reasons the von Karman Institute has brought together experts in the field of low-pressure turbine and condenser research to provide advanced Lecture Series in these subjects. This volume is a selection of edited lectures from these Series. The lecturers, from Europe and the U.S.A., are specialists in their particular fields of research and development and this book is intended to provide students, researchers, and turbine plant designers with a view of the improvements in knowledge and techniques in recent years. Particularly significant, for example, are the emergence of theories for viscous compressible flow and the capability to measure steam wetness fraction, as described in Chapters 3 and 6, respectively, which must lead to further advances in turbine performance in the future.

By including the fluid mechanics of the turbine and condenser, this publication complements the previous von Karman Institute book "Two Phase Steam Flow in Turbines and Separators" edited by M. J. Moore and C. H. Sieverding (Hemisphere, 1976) and adds significantly to the treatment of wet steam flow in turbines.

M. J. Moore
C. H. Sieverding
(from Editor's Preface)

The Chemical Engineering Guide to Heat Transfer—Volume I: *Plant Principles*, Volume II: *Equipment*, eds., K. J. McNaughton and the Staff of *Chemical Engineering*, Hemisphere Publishing Corp., New York, 1986.

When I was studying chemical engineering at college, I loved heat transfer. It was neat. $Q = CA T$. That's all I needed to know. And heat-in equals heat-out. Boy! If only the rest of life was so simple!

Some people say that engineers are drawn to science because they lack the skills to deal with people. That scientific types take comfort in being able to handle a field that responds according to inviolate laws, unlike their lawless and unpredictable fellow beings. Other observers, perhaps more charitable, suggest that those who inherit the skills to deal with a scientific universe may not give themselves the time to come to grips with the more elusive rules that attempt to explain human behavior.

I think both are fascinating fields worth pursuing. And who can say that the two won't come together? What with all the exciting developments in our understanding of molecular biology, surely we are overdue for some breakthroughs in phychology as well.

As it turns out, heat transfer isn't so simple anyway. But it is neat. And we are very fortunate to have developed our communications skills so well. In this book, for instance, we have accumulated ten years of practical wisdom from the pages of *Chemical Engineering*, on the subject of heat transfer—basic plant principles.

Here, assembled in one volume, are the writings of fellow chemical engineers who also graduated with the basic understanding that $Q = CA T$ and that heat-in equals heat-out. But they went on to specialize, and now they share with us their knowledge about how the theory is applied in the plants of today's chemical process industries.

All the different types of heat exchangers and how to select the right one. Shell-and-tube equipment, how it works. Design—calculator programs and modeling. Heat recovery—optimizing, conserving, saving, networks, efficiency. Steam—the conveyor of heat. And of course, cost—the bottom line.

Life may not be so simple, but this book is going to make your life easier when it comes to heat transfer applications in the plant. And so will the companion volume, which covers all the different sorts of heat transfer equipment.

K. J. McNaughton
(from Editor's Preface)

Mechanical Design of Process Systems, Volume 2: *Shell-and-Tube Heat Exchangers, Rotating Equipment, Bins, Silos, Stacks*, by A. K. Escoe, Gulf Publishing Co., Houston, 1986.

This book's purpose is to show how to apply mechanical engineering concepts to process system design. Process systems are common to a wide variety of industries including petrochemical process, food processing and pharmaceuticals, power generation (including cogeneration), ship building, and the aerospace industry. The book is based on years of proven, successful practice, and almost all of the examples described are from process systems now in operation.

While practicality is probably its key asset, this second volume contains a unique collection of valuable information, such as practical approach to bin and silo design as well as practical methods of controlling wind vibrations of stacks using vortex strakes; new information on nozzle loadings on compressors and turbines; comprehensive discussions and ex-