Int. J. Heat Mass Transfer. Vol. 27, No. 8, pp. 1431–1432, 1984
Pergamon Press Ltd. Printed in Great Britain

BOOK REVIEWS

HENRI FENECH (Editor), **Heat Transfer and Fluid Flow in Nuclear Systems.** Pergamon Press, Oxford, 1981, 582 pp.

ENGINEERS and scientists with an interest in the thermal hydraulic aspects of nuclear power-generation systems are often faced with the difficulty of bridging the information gap between current design practice and the fundamental principles of flow and heat transfer.

This book sets out to provide such a link: an ambitious attempt, considering the possible scope of the material.

Faced with the task of addressing the complexities of flow geometry and the differing physical phenomena encountered in analysing the various reactor types, the editor has wisely opted for a modular approach.

Each of the self-contained chapters in the book is concerned with the thermal hydraulic considerations in the design of a particular nuclear system, and is contributed by authors of some standing in the field concerned.

The book is divided into six chapters, starting with a useful introduction to the general considerations governing the thermal design and performance requirements of reactor cores. Thereafter, separate chapters describe the thermal hydraulic considerations influencing design in pressurized subcooled light water systems (PWRs), boiling water reactor systems (BWRs), liquid-metal cooled systems (LMFBRs) and helium-cooled systems (HTGR, HTR and GCFR). The final chapter contains a useful analysis of the flow and heat-transfer phenomena presumed to occur in the heat exchangers and steam generators associated with PWR, LMFBR and HTGR systems.

Each chapter contains a large and (perhaps more important) up-to-date list of references, to enlarge on the topics covered.

For a given reactor system, the scope of possible material for inclusion is large, and the information requirements of the various categories of readership are often difficult to reconcile. The various contributors have to tread a difficult path between the repetitious presentation of trite material and the need to explain complicated phenomena. On the whole, the contributors manage a successful compromise, and it is a credit to the editing of Dr Fenech that the subtle changes of style and approach, inherent in such multi-author books, are not intrusive.

The book also cites examples of the use of computer programs as aids in design and in the simulation of operational transients and accident conditions. It is perhaps a trifle dismissive of recent advances in the use of multidimensional codes, whose application to the behaviour predictions of large and complex nuclear systems is only now becoming practicable with the enhanced power of modern computers.

In summary, this book is well written and contains much useful information. It should provide a useful source book for those interested in the subject.

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TOKURO MIZUSHINA and WEN-JEI YANG, **Heat Transfer in Energy Problems.** Hemisphere, Washington, DC, 1983, 241 pp., $69.50, ISBN: 0-89116-251-8.

THIS volume is a collection of some 31 papers presented at a seminar sponsored by the U.S.–Japan Cooperative Science Program from 29 September to 2 October 1980 in Tokyo. The program was jointly administered by the U.S. Division of International Programs with the National Science Foundation and the Japan Society for the Promotion of Science. The volume is hard-back in A4-trimmed size and although the contents are prepared from camera-ready copy, the quality of reproduction is good and the general appearance is attractive.

The objectives of the seminar were to provide scientists from the two countries with an opportunity to exchange first-hand information, to identify key problems, to discuss research strategies and to promote areas of future cooperative heat transfer, with particular reference to energy conversion, transfer, disposal and storage. The emphasis of the volume is on four important areas of heat transfer related to energy utilization and development.

High-temperature heat transfer covers the basic phenomena of film and impingement cooling, radiation and radiative properties of metals and alloys; applications centre around nuclear-process heat exchange in the HTGCR, the He–He intermediate heat exchanger and nuclear power safety-reflooding and core-uncovery phenomena.

In high-flux heat transfer the basic phenomena in boiling and condensation are considered, including critical heat flux, metal vapour condensation and droplet evaporation on heated surfaces, with applications to power and propulsion systems and gas–liquid flows. Papers on high-performance heat transfer surfaces deal with both single-phase flows and flows with phase change, together with detailed treatment of augmented surfaces for nucleate boiling.

Novel heat transfer techniques include those involved in the use of new energy sources like solar energy, ocean thermal energy conversion, aqueous solutions of inorganic salts and geothermal energy, together with sensible heat and phase-change storage. The latter introduces heat transfer problems in certain advanced power systems such as solar-thermal receiver technology, coal-fired MHD and nuclear-fusion power system concepts. Heat transfer problems in mist-cooled condensers for geothermal power plants are also discussed.

Coverage of this wide range of topics (perhaps too wide for any individual to have a specific interest in more than a fraction of them) is, however, somewhat uneven. This is largely because the majority of the papers, which are review articles, are interspersed with others reporting original research of an often specialized nature. It is therefore debatable whether a cohesive and complete state-of-the-art picture in any of the four main areas represented can be gained from the volume. There are nevertheless some excellent reviews on particular topics; those on new energy resources, with 141 references, and condensation, with 185 references, seem especially comprehensive. But at $69.50 the individual would appear less likely to buy a collection of such widely-ranging papers than, say, the library of a university or a power-industry concern.

It is a pity that in such rapidly-moving technological areas this volume has appeared some three years after the seminar was held, a factor that can hardly enhance its value for someone seeking up-to-date information.

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R. K. SINNOTT, **Chemical Engineering: Design.** Pergamon Press, Oxford, 1983, 820 + 18 pp., £13.50.

"AN Introduction to Chemical Engineering Design" constitutes Volume 6 of the undergraduate series of textbooks on "Chemical Engineering" by J. M. Coulson and J. R.

Richardson. The prime objective of the new volume is to assist students with their design projects.

The book consists of 14 chapters averaging 52 pages, and a set of seven appendices. A wide coverage is given, and the stated technique of providing sufficient information for immediate purposes plus references to obtain further details is commendable.

The reader is taken through the basic topics of design methodology, material balances, energy balances, flow-sheeting, piping and instrumentation (content rather superficial), costing (content clear and competent), materials of construction, design data, and safety—9 chapters and some 300 pages. Chapter 10, "Equipment Selection, Specification and Design" is mainly concerned with phase separation processes, gas/liquid/solid, and thus is dubiously titled; the treatment is generally superficial (i.e. comminution) and occasionally outdated (i.e. hydrocyclones). The next two chapters "Separation Columns (Distillation and Absorption)" and "Heat-transfer Equipment" are very good, though somewhat limited attention is given to batch fractionation and the less common types of heat exchangers.

Is the author a lone voice advocating a minimum LMTD correction factor of 0.85 for shell and tube heat exchangers, or is his value a typographical error? An excellent chapter "Mechanical Design of Process Equipment" is followed by the final one "General Site Considerations" which is somewhat lightweight.

The Appendices form a useful compilation—graphic symbols for piping systems and plant based on BS 1533: Part 1: 1976, a trio of BASIC programs for mass balance/simple flow-sheeting with some 467 lines in total, a corrosion chart, a physical property data bank for 481 compounds, conversion factors for non-SI to SI units, standard flanges, and a set of eight design projects based on those of the Institution of Chemical Engineers.

Each chapter except the last is terminated with a list of symbols and nomenclature with appropriate dimensions under the heading MLTθ or a sub-set. Whilst dimensions may lend themselves to general use, a listing of SI units is preferred, particularly as they are used throughout the book. Or why not give both?

The standard of presentation is high. The text is very readable and well illustrated with many clear diagrams. Some 93 worked examples are a valuable asset to the book.

This volume is a welcome addition to the series and will be favourably received by its intended readership.

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