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BOOK REVIEW

Heat Transfer Fluids and Systems for Process and Energy Applications

J. Singh

One of the unfortunate consequences of the rapid development of modern technology is the emergence of buzz-words which help to obscure the precise meaning of concepts. System is one such word. Even amongst older subject areas such words can be found, performance and efficiency being common examples. What does the book mean by efficiency, unspecified and undefined, of a heat exchanger: does it signify low heat loss from the apparatus, or a small heat exchange area for a given duty, or low capital or maintenance cost?

In spite of the claims the book makes in relation to systems and what they entail, it is not much more than an elementary and rather superficial book on heat transfer, with a little power-cycle thermodynamics added, plus a certain amount of acquired wisdom of a practising engineer thrown in for good measure. What the book provides, that cannot perhaps be readily found in other books, are data on unconventional heat transfer fluids used in the process industries.

The book does not pretend to go deeply into fundamental aspects of heat transfer, and it 'succeeds well' in limiting its objectives. By and large, the book concentrates in its more analytical sections on quoting heat transfer and fluid flow correlations (not always the best or latest ones) rather than explaining their background or derivations. This can be dangerous, and the reviewer has rather strong views about this. Where a book concentrates on real explanations of fundamentals, the reader learns to check his own working. Where a reader is merely provided with working equations with a minimum of background, it is doubly important that the equations are presented in a foolproof way.

Simply to say that SI is being used is not good enough, when sometimes base units and coherently-derived units are being used, and sometimes it is SI multiples which are intended. It does matter in practice that on occasion energy is measured in Joule units, and elsewhere in kiloJoule units. The answer to the state of confusion which can arise is, of course, to present all equations in their proper physical form, that is, so that they will 'work' with any consistent and coherent system of units, and where each physical quantity stands for

physical quantity = number × unit

Admittedly, there exists an alternative possibility, namely that of allowing the symbol for a physical quantity to stand for the number alone, although this alternative is not to be encouraged for very good reasons. What is totally unacceptable is to mix up the two ways of writing equations without any warning being given to the user when a switch from one mode to the other is being made. The dangers associated with such muddles are exemplified by equation (3.1)

$$u_g = h_g - Pv_g$$

relating the internal energy u_g to the enthalpy h_g of a saturated vapour. This equation is a perfectly legitimate physical equation, but when one is instructed that h_g is a number in kJ, P a number in N/m^2 and v_g a number in m^3/kg, one begins to wonder! The text abounds with equations which are dimensionally inconsistent.

There is a large number of real weaknesses in the book, too numerous to list them all here: they include an unsatisfactory treatment of friction factors and of reversibility, non-mention of essential assumptions made in deriving equations for multi-stage compression and of log-mean-temperature-difference, a trivial and misleading discussion of radiation heat transfer, a poor discussion of condensation and a misunderstanding about 'burn-out' in boiling, a misinterpretation of the effect of turbulence in tube banks, a mix-up between Rankine and Carnot-cycle efficiencies, presentation of some obsolete heat transfer data, etc.

By and large this is a superficial book for which there are many better alternatives, but it may find space on some bookshelves for the reason mentioned at the end of the second paragraph.

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