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Book review

Mostafa Ghiaasiaan, S., Two-Phase Flow, Boiling, and Condensation in Conventional and Miniature Systems, Cambridge University Press, 2008, ISBN978-0-521-88276-7

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This book is divided into two main parts. The first part, which consists of 10 chapters, is devoted primarily to both fundamental and applied aspects of gas–liquid two-phase flows, and the topics covered in it include the following: interfacial phenomena and conditions; flow regimes and maps for vertical tubes, horizontal tubes, and rod bundles; averaging approaches used in the derivation of practically viable mathematical models; one-dimensional and drift-flux models; calculation of pressure drops; and special considerations and modifications that are necessary when dealing with such flows in mini- and micro-channels. The second part of this book consists of an additional seven chapters and covers the areas of boiling and condensation, again from both fundamental and applied points of view. The topics covered in this second part include the following: pool boiling; internal-flow boiling in conventional (or macro-), mini- and micro-channels; external condensation on vertical plates and horizontal tubes, without and with the presence of non-condensable gases; internal-flow condensation; direct-contact condensation on liquid jets and drops; special considerations needed when dealing with internal-flow condensation in mini- and micro-channels; and the speed of sound and choking in gas–liquid two-phase flows. The book also has 11 appendices in which thermophysical and transport properties of saturated water and steam, and some selected refrigerants, are presented.

Over the last 80 years, several excellent books, a few very useful handbooks, and numerous journal papers, refereed conference articles, and research reports have been published in the general areas of gas–liquid two-phase flow, boiling, and condensation. However, this is the first single-author book that covers all of the topics mentioned in the previous paragraph, and it also contains a very good list of important publications (seminal and recent). These features of the book make it a valuable reference for researchers working on gas–liquid two-phase phenomena, without and with phase-change. The author is to be commended for the courage, expertise, resourcefulness, dedication, and persistence he has demonstrated in undertaking and successfully completing the enormous and challenging task of writing this book.

The first edition of any book that covers a lot of challenging technical topics concisely may be expected to have a few shortcomings, some serious and others minor, as is the case with this book. The discussions of some of the fundamental topics are overly brief, incomplete, or vague (because of over-usage of terms such as ‘can’, ‘often’, ‘usually’, ‘probably’, ‘evidently’, ‘highly’, ‘typically’, and ‘reasonably’, without suitable qualifications), and thus confusing and, occasionally, imprecise: examples include discussions of some basic aspects of turbulent flows in Sections 1.7 and 3.6, averaging procedures presented in Section 3.2, opening remarks on boiling in Section 11.1, and introductory comments on choking in Section 17.1. The terms ‘interface’ and ‘interphase’ are used interchangeably throughout the book, without proper elaboration, even when it is first done in Chapter 2. This is an unfortunate oversight, because these terms do have specific and distinct meanings both in the subjects considered here and also in other subjects such as adhesives, coatings, and composite materials. Numerous empirical and semi-empirical correlations are provided in the book, but only a few (if any) are associated with specific, authoritative, recommendations that were expected by this reader, given the author’s extensive experience and many accomplishments in both industry and academia. There are several minor inconsistencies in the book. For example, in Chapter 10, flow passages with hydraulic diameter in the range 100 μm–1 mm are categorized as mini-channels; but in Chapter 14, mini-channels are defined as flow passages with hydraulic diameter in the range 100 μm–3 mm. Another example of such a minor inconsistency is the following: the specific volume, internal energy, enthalpy, and entropy of saturated water and steam are labeled, correctly, as ‘thermodynamic properties’ in the title of Appendix A; next, the specific volume, specific heat at constant pressure, dynamic viscosity, thermal conductivity, and Prandtl number of these substances are labeled as ‘transport properties’ in the title of Appendix B; and then in the title of Appendix C, all of the aforementioned properties and also the surface tension of some selected refrigerants are labeled as ‘thermodynamic properties’. This reader also found the writing style somewhat uneven and, frankly, mildly irritating: the text is abrupt or jerky in some places and a bit too repetitive in others; and

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there is unnecessary over-usage of second-person constructions (prefixed by the terms 'one', 'us', or 'we') throughout the book. Potential readers may also find it useful to note that this book contains very few (or no) discussions of (or references related to) experimental techniques, boiling and condensation of binary liquid mixtures, techniques for enhancing boiling and condensation, and gas–liquid two-phase phenomena in low-gravity environments.

In summary, the strong points outlined in the first two paragraphs of this review make this book a welcome addition to the repertoire of publications on gas–liquid two-phase flows, boiling, and condensation. However, because of the shortcomings summarized in the previous paragraph, this reader is unable to give this book an enthusiastic endorsement.

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