

REVIEW

Boiling, Condensation and Gas–Liquid Flows. By P. B. Whalley. Oxford Science Publications, 1987. 291 pp. £40.

Two-phase flow has been an active topic of research since the pioneering work of Martinelli in the 1940's. There have, however, been few books devoted to the subject and those that have been published are mainly lengthy and undigested compilations of current research. Such books, though they contain exhaustive detail of value to other research workers are of little help to those who have limited understanding of the subject. Under these circumstances, any book that attempts to provide an elementary introduction for student use must be welcomed with open arms.

Dr. Whalley attempts this in his book, and in the space of some 240 pages he gives a simplified summary of many aspects of two-phase flow. The book falls into two sections of almost equal length. The first is concerned with adiabatic systems; the definition of flow regimes, the behaviour of bubbles and slugs, the prediction of frictional pressure gradients, interfacial wave phenomena and its influence on entrainment, critical flows, instabilities and flooding. The second half of the book is concerned mainly with boiling. The author considers pool and film boiling, nucleation and critical heat fluxes, burnout, post-burnout heat transfer and the rewetting of hot surfaces. Near the end there are two chapters on condensation, and the book concludes with a set of eleven worked examples. There are however no problems set for the student, which will reduce the attractiveness of the book for course work in American Universities.

The book is obviously based on the course the author gives at Oxford and this provides both its main strength and its principal weakness. The author is clearly experienced at selecting the essential features of the subject and presenting them in a logical framework and in a quantity appropriate to a University course. Each topic is discussed concisely, with the author concentrating on obtaining results that are directly applicable. Simple correlations are presented which enable the reader to estimate pressure gradients, void fractions, heat transfer coefficients etc., in a great many situations of practical importance. The author takes the courageous step of recommending particular calculational procedures, a most welcome change from most other books on two-phase flow in which the authors seem to feel obliged to quote every correlation that has been proposed, thereby leaving the reader totally confused.

The book's weakness is that it does not seem to be based on the author's lecture notes but simply to be the notes themselves, without the additional spontaneous explanations that convert notes into a lecture. Facts are slapped down before the reader with astonishing rapidity and very little in the way of commentary. Consequently the book will be more useful as a supplement to a lecture course than as an alternative to one. Prandtl, though a good author in his own right, allowed his lectures to be converted into a book by one of his students. I fear that Whalley needs his Tietjens.

A short introductory text to so large a subject must be selective in its coverage and it is therefore unfair of me to criticise the author's selection of topics. Nonetheless I must say that I would not have selected the regime plot presented in Chapter 2 which suggests that bubble flow cannot occur below a liquid velocity of 3 m/s. This is

unfortunate as perhaps the most familiar bubbly flow and certainly that of most interest in chemical reactors is that through effectively stagnant liquid. Neither would I have recommended the Grace and Clift correlation for bubble rise velocity, at least in the graphical form as presented in this book, since at a scale in which 1.7 cm represents a factor of ten this correlation is effectively useless. Perhaps the author has some reason for distrusting the accuracy of correlations, such as those of Wallis, which can be expressed in algebraic form, but he does not say so.

Despite these criticisms, which are mainly directed at the selection of material and which are arguably made irrelevant by the title, the book must be acknowledged as the best text on two-phase flow for undergraduate use. It presents the basic facts of two-phase flow in a concise form, unencumbered with excessive detail. Furthermore it is an excellent compilation of useful correlations which will prove invaluable for design purposes. The publication of this book will be welcomed by all those concerned with two-phase flow and in particular by those who teach the subject.

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