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Book Reviews

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Computational Models for Turbulent Reacting Flows

Rodney O. Fox, Cambridge University Press, New York, 2003, 419 pp., $120.00 (hardback), $55.00 (paperback)

Modeling of turbulent reacting flows has been the subject of broad investigations for over half a century. Many legitimate models are currently available, and new closure strategies are suggested regularly. This book provides a reasonable overview of some of these methodologies. The primary emphasis is placed on single-point probability density function (PDF) methods. In my opinion, these methods provide one of the most systematic means of predicting turbulent reacting flows. So it is nice to see that the major part of the book is devoted to this subject. In this regard, the book would be of significant use for those involved or interested in predicting such flows in the context of Reynolds-averaged Navier–Stokes (RANS). The author does a commendable job of introducing the PDF, its implementation, and the associated closure issues and finally how to solve the PDF transport equation numerically. In doing so, a systematic procedure is provided without requiring (or assuming) a strong background in probability theory (even though some background in basic stochastic processes would be helpful).

With such a general title, the reader may expect the book to cover all of the current computational strategies for turbulent combustion prediction. This is not the case! There are several other phenomenological models (some even in current commercial packages), such as the eddy-breakup, RNG, spectral, fractal, etc., that are not covered. Some other computational/modeling strategies such as the random vortex/blob methods, transport element methods, etc., are also omitted. Moreover, the extent of coverage on other topics, such as direct numerical simulation, large eddy simulation, chemistry, kinetics, and the like, is brief. These explain the lack of explicit citation of some of the widely referenced texts and volumes[1–5] in the bibliography. In addition to PDF methods, the author does an excellent job of describing other methodologies. None are covered to the extent of PDF methods, but enough details are provided to send the reader in the right direction. I also admire the author for employing standard nomenclature. This would make it easy to study this book in conjunction with other related texts[6,7] heavily cited in the book. The chapters and the (sub)sections are organized logically, the equations are presented systematically, and a step-by-step procedure is followed in derivation of these equations, even the ones that are very complex. In this regard, the book would be an excellent source for beginners. It can even be used as a text for a graduate specialized course, though the lack of exercises and or worked problems may discourage its use in this context. I have already experienced the positive impact of the book. It has proven useful to expedite the learning process of my new graduate students. In summary, I strongly recommend this book, and I feel it would make an excellent addition to any personal or public library.

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