Book Review

A. K. Gupta, D. G. Lilley, and N. Syred, *Swirl Flows,* Abacus Press, Tunbridge Wells, England, 1984, xiii + 475 pp, $50.00

Even though many practical combustion processes involve swirl, classical reference books devote little attention to mixing and combustion phenomena encountered in swirl flows. *Swirl Flows* fills this gap and is a valuable reference work for combustion scientists and engineers.

The book provides a general description of swirl flow phenomena. However, applications of swirl to combustion phenomena are emphasized; therefore, in spite of its title, *Swirl Flows* is particularly relevant to the field of combustion. Specific consideration is given to swirl-stabilized combustion, cyclone combustion chambers, hazardous-waste incinerators, tangentially fired furnaces, gas turbine combustors, gasoline engines, diesel engines, and fire whirl. Devices that do not involve combustion are also considered, e.g., cyclone separators, Hilsch tubes, etc.

Background for swirl flow and combustion is provided in the first two chapters. Chapter one treats the generation and specification (through the swirl number) of swirl, theoretical and experimental techniques, and applications. Theoretical methods include one-dimensional, integral, and higher-order turbulence models. Hydrodynamic aspects are emphasized; therefore, many readers will have to consult other reference works for treatments of scalar properties in these flows—particularly in flames. In contrast, some experimental methods (laser holography, thermocouple compensation, laser-speckle metrology, etc.) are treated in greater detail than might be expected for a book of this nature. Chapter two considers flame structure, effects of turbulence on flames, well-stirred reactor theory, and flame stabilization by bluff bodies and swirl. An aspect of both chapters that will probably annoy newcomers to the field is that many formulas are set down without citation and with only limited justification.

Chapters three and four present the main theme of the book, describing low- and high-swirl phenomena, e.g., nonrecirculating and recirculating swirl flows. This is an excellent review of the field, which considers work up to the early 1980s. Measurements are discussed to highlight effects of swirl. Methods of analyzing swirl flows, including a general description of existing computer codes, are described and compared with measurements. Although this portion of the book is generally well done, a number of formulas are presented with only a qualitative indication of their limitations. Perhaps this reflects our relatively poor understanding of swirl flows at present, however, more specifics would be desirable. Estimates of theoretical and experimental uncertainties are also lacking during comparison of predictions and measurements.

The last two chapters cover cyclone separators and combustors and swirl flows in practical combustion devices. Effects of swirl on pollutants and the noise of combustion processes are also touched upon. A good overview of these topics is provided, with adequate citations to direct the interested reader when more details are needed.

In summary, the authors are to be congratulated for preparing a novel work that brings together information on swirl and its application to combustion devices. *Swirl Flows* is a useful addition to the combustion literature.

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