

Computational Fluid Dynamics: An Introduction for Mechanical Engineering Students

This book introduces the basic concepts of the Computational Fluid Dynamics (CFD) of single-phase and multiphase flows. While the opening chapter focuses on the key equations that are solved numerically using classical CFD codes, the intention is not just to show these equations, but also to present key ideas of the calculus on which the formulations of these equations, and the analysis of other parts of the book, are based. Various approaches to the discretisation of conservation equations describing single-phase flows and the methods for solving the algebraic equations are demonstrated, including the details of some derivations usually omitted in classical textbooks. Also, the details of the SIMPLE algorithm is described. In contrast to most classical CFD books, this textbook also develops the basic principles of modelling multiphase flows, including approaches to modelling spray formation and droplet dynamics, analyses of flow instabilities, and droplet heating and evaporation. Completing the coverage, approaches to modelling the processes in multicomponent droplets, including puffing and micro-explosion in composite droplets, are discussed and the modelling of thermal radiation transfer using CFD codes is treated.

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