# COMPUTATIONAL FLUID DYNAMICS APPLICATIONS IN GREEN DESIGN


The term "green design" or "green engineering" has become ubiquitous in recent years, with references even on the covers of trade journals and magazines. With simulation and analysis, going green offers many benefits. Green design defines as "the design, commercialization and use of processes and products that are feasible and economical while reducing the generation of pollution at the source and minimizing the risk to human health and the environment." So while green engineering encompasses environmental engineering, it also can refer to any engineering field in which environmental and human health impacts are minimized. Increasingly, the term has become associated with sustainable development, in which processes and products can continue to be produced indefinitely with a minimum of resource depletion or environmental degradation. Evidence is mounting that the impetus for "going green" and developing environmentally sustainable products is moving away from mere regulatory compliance to the realization that a significant new business opportunity is at hand. The realization marks a dramatic opinion shift. Today, many manufacturers see that developing sustainable products offers a sustainable competitive advantage. Along with increased awareness of environmental impact, well-known corporations have launched campaigns that show how they are developing green technologies. Major companies believe there is money to be made in developing environmentally friendly technology, which should encourage even the most contrarian environmentalist.

Computational Fluid Dynamics (CFD) is the science of predicting fluid flow, heat transfer, mass transfer, phase change, chemical reaction, mechanical movement, stress or deformation of related solid structures, and related phenomena by solving the mathematical equations that govern these processes using a numerical algorithm on a computer. The results of CFD analyses are relevant in: conceptual studies of new designs, detailed product development, troubleshooting, and redesign. CFD analysis complements testing and experimentation, by reduces the total effort required in the experiment design and data acquisition. CFD complements physical modelling and other experimental techniques by providing a detailed look into our fluid flow problems, including complex physical processes such as turbulence, chemical reactions, heat and mass transfer, and multiphase flows. In many cases, we can build and analyze virtual models at a fraction of the time and cost of physical modelling. This allows us to investigate more design options and "what if" scenarios than ever before. Moreover, flow modelling provides insights into our fluid flow problems that would be too costly or simply prohibitive by experimental techniques alone. The added insight and understanding gained from flow modelling gives us confidence in our design proposals, avoiding the added costs of over-sizing and over-specification, while reducing risk.

The use of Computational Fluid Dynamics to simulate engineering phenomena continues to grow throughout many engineering disciplines. On the back of ever more powerful computers and graphical user interfaces CFD provides engineers with a reliable tool to assist in the design of industrial equipment often reducing or eliminating the need for performing trial-and-error experimentation.

The chapters in this book testify to the vitality of engineering CFD research and demonstrate the considerable potential for use of these techniques in the future. The book is intended to serve as a reference for both researchers and postgraduate students.

The IEEF thank the work and commitment of all of the authors who submitted chapters according to our requests and dealt with our numerous comments.



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