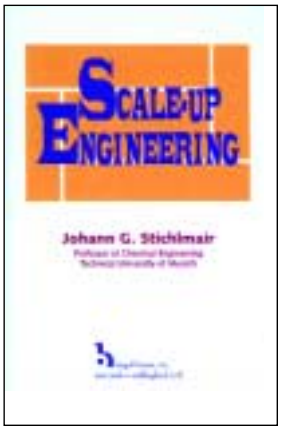
Books

Scale-up Engineering

Johann G. Stichlmair
Begell House, New York, NY, 216 pp., $76.50, 2002



"Scale-up Engineering" covers the practical application of dimensional analysis to experimental design, data analysis and equipment design. The book lays out an excellent summary of the key elements of dimensional analysis and its uses. Both the book and its chapters are excellently organized, concise and clear. Thorough examples for a number of common chemical engineering problems show practical applications of the techniques.

Design and operations engineers confronting problems not covered by standardized solutions will find this book very useful. Researchers and academics, as well, would do well to review the included recommendations for data analysis and presentation. The book is also suitable as a text for a graduate-level course in designing experiments and analyzing their results (although no typical textbook-style problems are included at the end of the chapters). It is highly recommended for those who wish to understand their engineering rather than rely on the rote application of formulas.

The major topics covered include: physical phenomena (Chapter 1); dimensionless numbers and groups (Chapter 2); applications (Chapter 3); similarity in engineering (Chapter 4); and partial similarity (Chapter 5). Each section includes many examples of common types of engineering problems that illustrate the concepts involved. The examples also provide a good starting guide for engineers new to the power of dimensional analysis to apply the techniques to other problems. A reference section and an index are also included in the book.

Of exceptional value, even to those who will never apply dimensional analysis techniques, are Chapters 1 and 2. These chapters include a superb discussion (along with examples) of clarity in data presentation and how to select useful versions of data to present. After many frightful occasions of having to fight through traditional but useless forms of data presentation, I would like to see every journal make Chapters 1 and 2 mandatory reading for every author.

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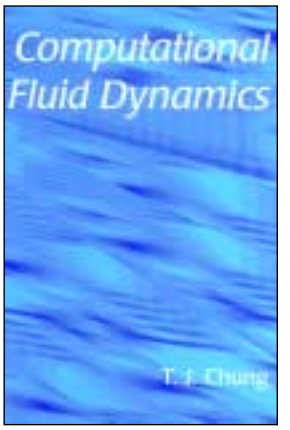
Computational Fluid Dynamics

T. J. Chung
Cambridge University Press, New York, NY, 1012 pp., $95, 2002



This comprehensive text starts with the basics of computational fluid dynamics (CFD) and covers every major aspect of the field, through modern, state-of-the-art techniques.

One thing that sets this book apart from many similar books is the equal treatment of the finite difference (FDM), finite element (FEM) and finite volume (FVM) methods. Workers in the field might become somewhat lopsided in their knowledge of these methods. This book does a beautiful job of pointing out the many advantages and shortcomings of each, and explains the history of their respective developments. For example, some of the recent developments in FEM have demonstrated superior performance over FDM for some applications. Chung starts by taking the reader through a simple example — solving a simple, linear second-order differential equation via FDM, FEM and FVM to arrive at the identical solution in each case. His goal is to explain how each method is developed and used, and to emphasize that a knowledge of all of them can be very valuable. Throughout the text, the applicability of each method to various flow problems is nicely summarized and contrasted against the other methods.

The treatment is very thorough, and a number of detailed example applications are provided, including turbulence, chemically reactive flows and combustion, acoustics, combined-mode radiative heat transfer, multiphase flows, electromagnetic flows, and relativistic astrophysical flows. Recent computer techniques in grid generation, domain decomposition, parallel processing, load balancing and multithreading are explained.

This book is well written and well indexed. Readers should have no trouble finding the topic of interest and following the clearly written text. It is an excellent tool for those who need an introduction to CFD, as well as for those who perform CFD calculations routinely, including researchers, students, and those in industry.

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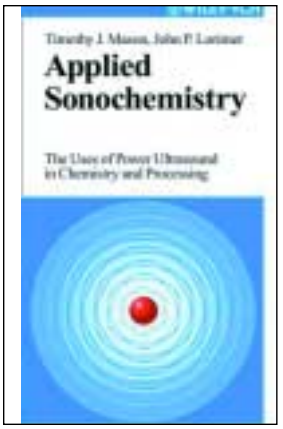
Applied Sonochemistry

Timothy J. Mason and John P. Lorimer
Wiley-VCH, New York, NY, 302 pp., $125, 2002



The authors, Professors Mason and Lorimer, of Coventry University (U.K.), have written a book that updates the applications of sound (and ultrasound) in chemistry and the process industries. Their book will be of interest to chemical engineers, research chemists and engineers who are involved in plating, surface cleaning, emulsification, the processing of fluids such as sewage, and the agglomeration and deagglomeration of solids dispersed in liquids.

This is a thorough review of the theory, mathematics and mechanics of how sonic energy can be used to carry out reactions, emulsify fluids and cause a wide variety of processes to take place. Chemical reactions can be speeded up. Polymerization reactions can be intensified. Electrochemical reactions, including electroreductive, electrooxidative and electroinitiated polymerization, can be influenced by the application of sonic energy. The electroplating of all metals is improved by the use of sonic energy — metal deposition is more uniform; energy use can be decreased; electroplating can be speeded up; and the emissions of gases from electroplating operations can be reduced.

The action of sonic energy results from forces caused by the cavitational collapse of bubbles in liquid. Very high, instantaneous temperatures are predicted. The results are affected by the temperature, viscosity and composition of the media, as well as the intensity and frequency of the sonic forces and the manner by which these forces are being applied to the operation. The mathematics of this action are described in the book.

Good descriptions are given of the various types and sizes of apparatus that can be used to generate sonic energy for the laboratory and for industrial processing. Described are: liquid- and gas-driven transducers; electromagnetic, magnetorestrictive and piezo-electric transducers; the ultrasonic cleaning bath; the horn or probe system; the whistle reactor; and the magnetically driven bar.

Many descriptions are given of different versions of the liquid flow-through reactor, which is used to apply sonic energy to fluid mixtures. This reactor is built in many sizes and configurations and is often used in large-scale industrial applications.

Each chapter is well-annotated, with references for further reading. The book should be of special value to all engineers and chemists involved in electroplating, emulsification, dispersion of solids in liquids, and surface cleaning.

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Principles of Optimal Design — Modeling and Computation, 2nd Edition

Panos Y. Papalambros and Douglass J. Wilde
Cambridge University Press, New York, NY, 390 pp., $120 hardcover, $44.95 paperback, 2000

This excellent book provides a comprehensive review of the creation of engineering models and their use in the search of optimal designs or operating conditions. The authors present a consistent implementation of their main thesis — that modeling and solving optimization problems should be seen in a unified way, where the understanding of the physical significance of the model allows us to simplify the mathematical optimization problem, while the exploration of the optimization procedure shows deficiencies in the model and incomplete consideration of issues related to the design problem.

The books starts with an interesting chapter on model construction and offers a brief discussion of deterministic model construction, as well as a brief analysis of neural networks and kriging. The authors follow this introduction with a discussion of model boundedness and equality and inequality constraints, and conclude the chapter with a useful checklist to check if a model is properly prepared. After this introduction to modeling and its interface with the optimality problem, the authors provide a solid introduction to optimization with several worked out numerical examples, an extensive discussion of the mathematics of boundaries as applied to optimization, and a discussion of specifics related to the actual creation of optimization algorithms from a computational point of view. The book concludes with a useful chapter containing hints on how to evaluate numerical derivatives, sources for optimization software and an optimization checklist.

This excellent book was not written from a chemical engineer's point of view, but its clear style and profusion of simple examples make it a welcome addition to any engineer's library.

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And yet, the one thing you still cannot scale horizontally through cloud services is your engineering team. Every time you grow the team new challenges come up. How do you onboard new employees? How do you safeguard the company culture? How do you maintain high standards in your coding and infrastructure? How do you keep your teams independent, engaged, quick to deliver and yet aligned with the companyâ€™s business goals? EPICâ€™s scale up specialists use Aspen/HYSYS* and other modeling methods to address the challenges of scale-up during the front-end engineering skid design stage of your pilot plant project. To read more about the specific challenges of scaleup, visit our Challenges to Scale Up page. *(Aspen HYSYS â€“ modeling and process simulation software for conceptual design and performance improvement of processes). Proving feasibility through 3-D modeling and design Process System & Process Skid Design. Scale up got expensive fast. An other solution is to buy cheaper, commodity boxes to scale out instead of up, distributing the application (database,â€¦) out over hundreds or even thousands of servers.Â But this approach can have diminishing returns (as discussed in performance engineering). For example: suppose a portion of a program can be sped up by 70% if parallelized and run on four CPUs instead of one. If: Î± is the fraction of a calculation that is sequential, 1 â^' Î± is the fraction that can be parallelized â€œScale-upâ€, Design of a Unimix system for the production of cosmetics based on laboratory and pilot tests. Despite improving our knowledge with respect to the physical processes in stirred tanks and application-specific peculiarities, often trial are still necessary for the design of an agitator system. Production scale plants can than be designed on the basis of lab and pilot scale test results by using the scale-up rules. Scaling Up Engineering: Managing People, Process, and Technology at Each Growth Stage. Tech Talks deploy 2020 Lightning Talks Team Management. By Al Sene.Â Al Sene, VP of Engineering at DigitalOcean, shares how you can avoid the pitfalls of a rapidly growing engineering team and anticipate key inflection points when scaling. Get tips on managing resources across people, process, and technology at each growth stage. Resources. Slides. About the Presenter. Al Sene is VP of Engineering at DigitalOcean.