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This text was designed with the goal of bringing together several areas that are often taught separately - namely, fluid mechanics, electrodynamics, and interfacial chemistry and electrochemistry - with a focused goal of preparing the modern microfluidics researcher to analyse and model continuum fluid mechanical systems encountered when working with micro- and nanofabricated devices.

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Brian J. Kirby currently directs the Micro/Nanofluidics Laboratory in the Sibley School of Mechanical and Aerospace Engineering at Cornell University. He joined the school in August 2004.

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Microfluidics refers to the behaviour, precise control, and manipulation of fluids that are geometrically constrained to a small scale (typically sub-millimeter) at which surface forces dominate volumetric forces. It is a multidisciplinary field that involves engineering, physics, chemistry, biochemistry, nanotechnology, and biotechnology. It has practical applications in the design of systems ...

Microfluidics - Wikipedia

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MICRO- AND NANOSCALE FLUID MECHANICS: TRANSPORT IN MICROFLUIDIC DEVICES This text describes the physics of fluid transport in microfabricated and nanofabricated liquidphase systems, with consideration of particles and macromolecules.

This text focuses on the physics of fluid transport in micro- and nanofabricated liquid-phase systems, with consideration of gas bubbles, solid particles, and macromolecules. This text was designed with the goal of bringing together several areas that are often taught separately - namely, fluid mechanics, electrostatics, and interfacial chemistry and electrochemistry - with a focused goal of preparing the modern microfluidics researcher to analyse and model continuum fluid mechanical systems encountered when working with micro- and nanofabricated devices. This text serves as a useful reference for practising researchers but is designed primarily for classroom instruction. Worked sample problems are included throughout to assist the student, and exercises at the end of each chapter help facilitate class learning.

"Intended for graduate and undergraduate students and as a reference for practicing researchers, this text focuses on the physics of fluid transport in micro- and nanofabricated systems"--Provided by publisher.

Microfluidics is a young discipline which enables scientists and engineers to handle fluids in the biochips of the future. The book is an introduction to this discipline. It presents in simple terms the most important notions of the domain: how fluids move on the chip, conveying materials, molecules, electrical charges, and heat.

Taking you to the forefront of the emerging field of Nanofluidics, this cutting-edge book details the physics and applications of fluid flow in nanometer scale channels. You gain a solid understanding of the fundamental aspects of transport processes and force interactions in microscale. Moreover, this unique resource presents the latest research on nanoscale transport phenomena. You find a comprehensive overview of fabrication technologies for nanotechnologies, including detailed technology recipes and parameters. The book concludes with a look at future trends and the possible directions this new field could take.

This book provides readers from academia and industry with an up-to-date overview of important advances in the field, dealing with such fundamental fluid mechanics problems as nonlinear transport phenomena and optimal

control of mixing at the micro- and nanoscale. The editors provide both in-depth knowledge of the topic as well as vast experience in guiding an expert team of authors. The review style articles offer a coherent view of the micromixing methods, resulting in a much-needed synopsis of the theoretical models needed to direct experimental research and establish engineering principles for future applications. Since these processes are governed by nonlinear phenomena, this book will appeal to readers from both communities: fluid mechanics and nonlinear dynamics.

Over the past several years, significant advances have been made in developing the discontinuous Galerkin finite element method for applications in fluid flow and heat transfer. Certain unique features of the method have made it attractive as an alternative for other popular methods such as finite volume and finite elements in thermal fluids engineering analyses. This book is written as an introductory textbook on the discontinuous finite element method for senior undergraduate and graduate students in the area of thermal science and fluid dynamics. It also can be used as a reference book for researchers and engineers who intend to use the method for research in computational fluid dynamics and heat transfer. A good portion of this book has been used in a course for computational fluid dynamics and heat transfer for senior undergraduate and first year graduate students. It also has been used by some graduate students for self-study of the basics of discontinuous finite elements. This monograph assumes that readers have a basic understanding of thermodynamics, fluid mechanics and heat transfer and some background in numerical analysis. Knowledge of continuous finite elements is not necessary but will be helpful. The book covers the application of the method for the simulation of both macroscopic and micro/nanoscale fluid flow and heat transfer phenomena.

This book describes physical, mathematical and experimental methods to model flows in micro- and nanofluidic devices. It takes in consideration flows in channels with a characteristic size between several hundreds of micrometers to several nanometers. Methods based on solving kinetic equations, coupled kinetic-hydrodynamic description, and molecular dynamics method are used. Based on detailed measurements of pressure distributions along the straight and bent microchannels, the hydraulic resistance coefficients are refined. Flows of disperse fluids (including disperse nanofluids) are considered in detail. Results of hydrodynamic modeling of the simplest micromixers are reported. Mixing of fluids in a Y-type and T-type micromixers is considered. The authors present a systematic study of jet flows, jets structure and laminar-turbulent transition. The influence of sound on the microjet structure is considered. New phenomena associated with turbulization and relaminarization of the mixing layer of microjets are discussed. Based on the conducted experimental investigations, the authors propose a chart of microjet flow regimes. When addressing the modeling of microflows of nanofluids, the authors show where conventional hydrodynamic approaches can be applied and where more complicated models are needed, and they analyze the hydrodynamic stability of the nanofluid flows. The last part of the book is devoted the statistical theory of the transport processes in fluids under confined conditions. The authors present the constitutive relations and the formulas for transport coefficients. In conclusion the authors present a rigorous analysis of the viscosity and diffusion in nanochannels and in porous media.

This comprehensive handbook presents fundamental aspects, fabrication techniques, introductory materials on microbiology and chemistry, measurement techniques, and applications of microfluidics and nanofluidics. The second volume focuses on topics related to experimental and numerical methods. It also covers fabrication and applications in a variety of areas, from aerospace to biological systems. Reflecting the inherent nature of microfluidics and nanofluidics, the book includes as much interdisciplinary knowledge as possible. It provides the fundamental science background for newcomers and advanced techniques and concepts for experienced researchers and professionals.

This volume consists of the state-of-the-art reports on new developments in micromechanics and the modeling of nanoscale effects, and is a companion book to the recent Kluwer volume on nanomechanics and multi-scale modeling (it is entitled Trends in Nanoscale Mechanics). The two volumes grew out of a series of discussions held at NASA Langley Research Center (LaRC), lectures and other events shared by many researchers from the national research laboratories and academia. The key events include the 2001 Summer Series of Round-Table Discussions on Nanotechnology at ICASE Institute (NASA LaRC) organized by Drs. V. M. Harik and M. D. Salas and the 2002 NASA LaRC Workshop on Multi-scale Modeling. The goal of these interactions was to foster collaborations between academic researchers and the ICASE Institute (NASA LaRC), a university-based institute, which has pioneered world-class computational, theoretical and experimental research in the disciplines that are important to NASA. Editors gratefully acknowledge help of Ms. E. Todd (ICASE, NASA LaRC), the ICASE Director M. D. Salas and all reviewers, in particular, Dr. B. Diskin (ICASE/NIA, NASA LaRC), Prof. R. Haftka (University of Florida), Dr. V. M. Harik (ICASE/Swales Aerospace, NASA LaRC), Prof.

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