



Theoretical Microfluidics (Oxford Master Series in Physics)

Henrik Bruus

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Microfluidics is a young and rapidly expanding scientific discipline, which deals with fluids and solutions in miniaturized systems, the so-called lab-on-a-chip systems. It has applications in chemical engineering, pharmaceuticals, biotechnology and medicine. As the lab-on-a-chip systems grow in complexity, a proper theoretical understanding becomes increasingly important.

The basic idea of the book is to provide a self-contained formulation of the theoretical framework of microfluidics, and at the same time give physical motivation and example from lab-on-a-chip technology. After three chapters introducing microfluidics, the governing questions for mass, momentum and energy, and some basic flow solutions, the following 14 chapters treat hydraulic resistance/compliance, diffusion/dispersion, time-dependent flow, capillarity, electro-and magneto-hydrodynamics, thermal transport, two-phase flow, complex flow patterns and acousto-fluidics, as well as the new fields of opto-and nano-fluidics. Throughout the book simple models with analytical solutions are presented to provide the student with a thorough physical understanding of order of magnitudes and various selected microfluidic phenomena and devices.

The book grew out of a set of well-tested lecture notes. It is with its many pedagogical exercises designed as a textbook for an advanced undergraduate or first-year graduate course. IT is also well suited for self-study.

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