

# Preface

This book aims to provide an elementary interpretation on *physical* aspects of fluid flows for beginners of fluid mechanics in physics, mathematics and engineering from the point of view of modern physics. Original manuscripts were prepared as lecture notes for intensive courses on Fluid Mechanics given to both undergraduate and postgraduate students of theoretical physics in 2003 and 2004 at the Nankai Institute of Mathematics (Nankai University, Tianjin) in China.

Beginning with introductory chapters of fundamental concepts of the nature of flows and properties of fluids, the text describes basic conservation equations of mass, momentum and energy in Chapter 3. The motions of viscous fluids and those of inviscid fluids are first considered in Chapters 4 and 5. Emphasizing the *dynamical* aspects of fluid motions rather than static aspects, the text describes, in subsequent chapters, various important behaviors of fluids such as waves, vortex motions, geophysical flows, instability and chaos, and turbulence. In addition to those fundamental and basic chapters, this text incorporates a new chapter on superfluid and quantized vortices because it is an exciting new area of physics, and another chapter on gauge theory of fluid flows since it includes a new fundamental formulation of fluid flows on the basis of the gauge theory of theoretical physics. The materials in this book are taken from the lecture notes of intensive courses, so that each chapter in the second half may be read separately, or handled chapter by chapter.

This book is written with the view that fluid mechanics is a branch of theoretical physics.

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