

Preface

“Lecture Notes in Physics”, having a strong publishing history in fundamental physics research, has devoted a special volume to recent developments in the field of physics of rotating fluids and related topics. The present volume will comprise 23 contributed papers on the different aspects of rotating fluids, i.e. Taylor–Couette flow, spherical Couette flow, plane Couette flow, as well as rotating annulus flow.

In the seminal paper by G.I. Taylor, a powerful combination of theory and experiment was brought to bear on the stability of flow between rotating cylinders, now referred to as Taylor–Couette flow. The significance of his work lies in the fact that here, for the first time, an experiment in fluid dynamics and the theory, using the Navier–Stokes equations, could be compared and led to excellent agreement. Since that time ideas associated with rotating flows have been extended and have resulted in classic texts such as Greenspan’s “The theory of rotating fluids”.

In this present book we report on modern developments in the field where new mathematical ideas have been applied to experimental observations on a variety of related flow fields.

The aim of this volume is to provide the reader with a comprehensive overview of the current state of the art and possible future directions of the Taylor–Couette community and to include related topics and applications.

The first part of this volume is devoted to several new results in the classical Taylor–Couette problem covering diverse theoretical, experimental and numerical works on bifurcation theory, the influence of boundary conditions, counter-rotating flows, spiral vortices, time-periodic flows, low dimensional dynamics, axial effects, secondary bifurcations, spatiotemporal intermittency, Taylor–Couette flows with axial and radial flow, Taylor vortices at different geometries and transport phenomena in magnetic fluids.

The second part of this volume focuses on spherical Couette flows, including isothermal flows, vortical structures, spiral and wavy vortices, the influence of throughflow, thermal convective motions, intermittency at the onset of convection, as well as magneto-hydrodynamics in spherical shells.

Further parts are devoted to Goertler vortices and flows along curved surfaces, rotating annulus flows, as well as superfluid Couette flows, tertiary and quarternary solutions for plane Couette flows with thermal stratification and rotating disk flows.

We hope that the readers will find this volume useful, giving an overview of the latest experimental and theoretical studies on the physics of rotating fluids.

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