

Preface

This volume is a collection of lecture notes generated from the first two series of mini-courses of “Shanghai Summer School on Analysis and Numerics in Modern Sciences” held during the summers of 2004 and 2006 at Fudan University, Shanghai, China. The summer school programs attracted more than 130 participants each year, including graduate students, postdoctors, and junior faculty members from more than 30 universities in China and USA.

The purpose of the summer school is to promote the interaction and collaboration of researchers with expertise in scientific modeling, mathematical analysis and numerical simulations. The focus of the year 2004’s program was on the study of the multi-scale phenomena in complex fluids. The focus of the year 2006’s program was on multi-scale analysis in nonlinear partial differential equations and their applications.

The summer school hosted several mini-courses each year. During the summer of 2004, the instructors are Weizhu Bao (National University of Singapore), Thomas Hou (California Institute of Technology, USA), Chun Liu (Penn State University, USA), Jianguo Liu (University of Maryland, USA), Tiehu Qin (Fudan University, PRC) and Qi Wang (Florida State University, USA). During the summer of 2006, the mini-courses were taught by Zhaojun Bai and Albert Fannjiang (University of California at Davis, USA), Thomas Hou, Wenbin Chen and Feng Qiu (Fudan University, PRC), Chun Liu, and Xiaoming Wang (Florida State University, USA). There are also short lectures given by many distinguished visitors from around the world.

There are five chapters in this volume, covering a wide range of topics in both analysis and numerical simulation methods, as well as their applications.

Chapter 1, by Zhaojun Bai, Wenbin Chen, Richard Scalettar and Ichitaro Yamazaki, is on the numerical methods for quantum Monte Carlo simulations of the Hubbard Models.

Chapter 2, by Albert Fannjiang, is on the wave propagation and imaging in random media.

Chapter 3, by Thomas Hou, is on multi-scale computations for flow and transport in porous media.

Chapter 4, by Chun Liu, is on the energetic variational approaches of elastic complex fluids.

Chapter 5, by Qi Wang, is on the kinetic theories of complex fluids.

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Editors

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