Preface

This volume is based on lectures delivered at the international conference "New trends in harmonic and complex analysis", held May 7–12, 2007 in Voss, Norway, and organized by the University of Bergen and the Norwegian University of Science and Technology, Trondheim. It became the kick-off conference of the European Science Foundation Networking Programme "Harmonic and complex analysis and its applications" (2007–2012). The purpose of the Conference was to bring together both experts and novices in analysis with experts in mathematical physics, mechanics and adjacent areas of applied science and numerical analysis. The participants presented their results and discussed further developments of frontier research exploring the bridge between complex, real analysis, potential theory, PDE and modern topics of fluid mechanics and mathematical physics.

Harmonic and Complex Analysis is a well-established area in mathematics. Over the past few years, this area has not only developed in many different directions, it has also evolved in an exciting way at several levels: the exploration of new models in mechanics and mathematical physics and applications has at the same time stimulated a variety of deep mathematical theories.

During the last quarter of the twentieth century the face of mathematical physics changed significantly. One very important aspect has been the increasing degree of cross-fertilization between mathematics and physics with great benefits to both subjects. Whereas the goals and targets in the understanding of fundamental laws governing the structure of matter and energy are shared by physicists and mathematicians alike, the methods used, and even views on the importance and credibility of results, often differ significantly. In many cases, mathematical or theoretical predictions can be made in certain areas, but the physical basis (in particular that of experimental physics) for confirming such predictions remains out of reach, due to natural engineering, technological or economic limitations. Conversely, 'physical' reasoning often provides new insight and suggests approaches that transcend those that may be rigorously treated by purely mathematical analysis; physicists tend to 'jump' over apparent technical obstacles to arrive at conclusions based on physical insight that may form the basis for significant new conjectures. Mathematical analysis in a broad sense has proved to be one of the most useful fields for providing a theoretical basis for mathematical physics. On the other hand, physical insight in domains such as equilibrium problems in potential theory, asymptotics, and boundary value problems often suggests new avenues of approach.

We hope that the present volume will be interesting for specialists and graduate students specializing in mathematics and/or mathematical physics. Many papers in this volume are surveys, whereas others represent original research. We would like to acknowledge all contributors as well as referees for their great service for mathematical society. Special thanks go to Dr. Thomas Hempfling, Birkhäuser, for his kind assistance during preparation of this volume.

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