

Preface

Scheduled on the heels of the *atomic century*, the American Nuclear Society's international topical meeting on Mathematics and Computation seemed like an opportune moment in time to capture accomplishments in this area during the first half-century of *nuclear engineering*. Held in a semi-secluded part of the city of Gatlinburg, Tennessee, April 6–10, 2003, this gathering of prominent experts in the field and young professionals embarking on exciting careers in what promises to develop into a *nuclear renaissance* turned out to be the perfect venue for such a review. The conference was co-sponsored by three divisions of the American Nuclear Society, namely the Mathematics and Computation Division, the Reactor Physics Division, and the Radiation Protection and Shielding Division. The Technical Program of the conference revolved around the theme of its title, *Nuclear Mathematical & Computational Sciences: A Century in Review, A Century Anew*. The *Anew* component comprised contributed papers organized in 25 regular and special sessions on a broad variety of topics, plus a poster session and a panel session. The *Review* component of the conference comprised the lecture series that grew into this book. As Technical Program Chair (YYA) and Assistant General Chair (ES) of the conference, we decided to break with the traditional format of plenary sessions standard in technical meetings and organize a lecture series that takes stock of the state of the art in nuclear computational science at the turn of a new century. Thus the concept of the lecture series that led to the chapters of this book was born.

One of the first experts we solicited to present a lecture in the series was the late Dr. Ely Gelbard of Argonne National Laboratory at the time. In his gentle, but firm and persuasive manner, he declined preferring instead to participate as co-organizer of the lecture series. We jumped on the opportunity recognizing his long-standing, distinguished, and generous contributions to many subareas in nuclear computational science, and his many years of service in the field positioned him well to know the major areas to cover in the lectures and to nominate world-renowned lecturers. In short order the three of us came up with a slate of topics and a corresponding list of lecturers. The response of the nominated lecturers was supportive and enthusiastic, and by mid Fall 2001 what has later become known as the *Gelbard Lecture Series* was fully conceived, and a tentative idea of ultimately documenting the lecture contents in book chapters was initiated. Our charge to the invited lecturers was to provide an overview of the assigned topic aiming primarily at breadth of coverage,

with a sharp focus on its mathematical and computational aspects. Specifically we requested that each author provide a historical perspective of the conception of their topic as a major area of research in nuclear computational science, and to identify landmarks for the evolution of the topic through the end of the twentieth century. We further requested that the lecturers delineate the current state of the art in their assigned topic and to project into the future by exposing perceived challenges and opportunities for advancing the frontier of knowledge.

Our renowned lecturers did not disappoint and the lecture series was a smashing success, thanks to their dedicated effort and professionalism. The lectures, scheduled to open each half-day of the conference, were well attended, with conference participants packing the lecture hall on a consistent basis. Perhaps the only sour note that tainted the lecture series was the passing on April 18, 2002, of Dr. Ely Gelbard whose contributions to the success of the lecture series, and ultimately to the publication of this book, cannot be overstated. This great loss to the field of nuclear computational science overshadowed the conference leading to various observances of this sad event. The conference banquet included a memorial celebrating Dr. Gelbard's life and his significant contributions to nuclear computational science, and the lecture series was named after him in recognition of his involvement that propelled the series to success. Later, the contributing authors to this book agreed to dedicate it to the memory of Dr. Ely Gelbard.

Unfortunately death struck again with the passing of Dr. Richard Hwang on December 20, 2007, shortly after he completed the final revisions to his chapter appearing in this book. We are grateful for Richard's contribution to the success of the lecture series, for the chapter he composed in this book, and for his dedication to his research over the past 5 decades.

While the original list of topics envisioned in our early planning of the lecture series has not changed, the reader will notice a few differences between the lectures lineup and the chapters herein. First, Dr. Dan Cacuci who, for unforeseen circumstances, was unable to deliver his lecture on Sensitivity and Uncertainty Analysis at the conference has graciously composed the corresponding chapter for this book. Second, Dr. Kord Smith who presented the lecture on Reactor Physics at the conference apologized from composing the corresponding book chapter due to increased job-related responsibilities. We are grateful to Dr. Robert Roy for accepting to undertake such burden and for the excellent job he did in composing his chapter on Reactor Core Methods. Lastly, in composing Chapter 7, Elliott Whitesides recruited Mike Westfall and Calvin Hopper to help with the composition.

This book would not have been possible without the support and active involvement of many people over the span of 6 years. Most of all we wish to thank the authors who willingly and cheerfully accepted this additional burden to their normally hectic schedules. We are confident that the benefit to the field of nuclear computational science and the gratitude of its practitioners, especially the young scientists who will carry the torch into the future, will reward the authors' perseverance and patience during this long and arduous journey. We are grateful to Argonne National Laboratory's Dr. Roger Blomquist for composing the memorials to Ely Gelbard and Richard Hwang, and for reviewing the final version of Richard's

Chapter 5. The support and encouragement of Bernadette Kirk, Director of Oak Ridge National Laboratory's Radiation Safety Information Computational Center (RSICC) and General Chair of the Gatlinburg conference, was invaluable to the completion of this project. The technical help by Alice Rice of RSICC with bringing together the pieces of this book into a single volume is greatly appreciated. In addition, we wish to acknowledge the tacit approval and support of our respective institutions, The Pennsylvania State University and North Carolina State University (YYA), and the Nuclear Energy Agency of the Organisation for Economic Cooperation and Development (ES).

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