Preface

The science and technology of micro-scale devices and applications have received unprecedented levels of attention from the research community, at large, especially in the last couple of decades, thanks largely due to the advancements in micro- and nano-fabrication techniques. These advancements have made it possible to translate mental ideas and theoretical predictions into physical reality. From another perspective, the attention afforded to this micro-realm is motivated by a slew of novel applications particularly in bioengineering, electronics, and electromechanical fields. This is, of course, over and above the primary scientific motivation of delving deeper into the microscopic realm with the aim of uncovering new phenomena coupled with a deep and fundamental understanding behind them. Certain areas of this broad micro-realm, primarily electronics, have already developed to a mature stage; others remain mostly confined to the abstruse domains in the higher echelons of research labs. Still others are at a crucial junction of graduation from adolescence to a mature and well-established technology. The most striking feature in the scientific bases of all these areas is that they require the application of fundamental knowledge from diverse backgrounds so that any comprehensive study requires a truly interdisciplinary approach. Finally, as is true for any scientific discipline, the ultimate onus of the development of this micro-scale realm lies with the pool of human talent devoted to it. As micro-scale research and development grows and threads out into niche areas, an ever-increasing number of well-trained researchers are required to handle the burgeoning volume of study areas and to explore their potential applications. As the subject grows in its applications, continuous challenges are faced towards exploring newer scientific facets and developing deeper fundamental understanding for transforming research dreams over miniaturized scales into a practical reality.

This book is written to address, primarily, this issue of expanding and nourishing the talent pool geared toward the development of micro- and nano-scale research. The seven chapters comprising this book are mostly based on the invited lectures presented by various renowned speakers at the Indo-US Short Term Course: *Mechanics Over Micro- and Nano-scales* which was organized jointly by Indian Institute of Technology Kharagpur, India, and Bengal Engineering and Science University, India, during December 21–22, 2009. In keeping with the spirit of these

lecture sessions, the book chapters are aimed at the senior undergraduate and graduate student to first expose him/her to various exciting sub-areas and then to apprise him/her of the fundamental issues involved in micro- and nano-scale research. The term "mechanics" in the present context should not be viewed in a narrow sense as it pertains to the well-known standard undergraduate curriculum. Here, "mechanics" encompasses the broad mechanistic approach that is necessary to elucidate the fundamentals of the pertinent areas borrowing heavily, as and when necessary, from numerous physical and chemical concepts. In this respect, this book aims to augment the specialized training received by an individual student from his undergraduate training to prepare him well for more sophisticated work in these interdisciplinary areas. Indeed, the common thread coursing through all the chapters is the pedagogical stance adopted by each author. The editor and the team of authors have taken special care not to fall into the temptation of discussing, at length, their pet research areas and highlighting recent major advances. Rather, emphasis has been laid to highlight the essential fundamentals that are necessary to kindle deeper research thoughts. Nevertheless, references to ongoing research topics have been suitably placed in the text to highlight motivation for a particular kind of study and to keep the study material practically relevant.

The editor wholeheartedly thanks all the contributing authors who, in spite of their busy work schedules, managed to meet the deadlines within acceptable tolerances! The relentless efforts of Mr. Steven Elliot from Springer ensured that the intricate logistics of the publication procedure never got derailed from the initially planned time frame of completion. The editor also expresses his sincere gratitude to the 'Indo-US Centre for Research Excellence in Fabrionics' for financing the lecture series that acted as a prelude to this edited volume. A special note of thanks is due to Dr. Arabinda Mitra, executive director, Indo-US Science and Technology Forum, for his support in creating the center. The editor also acknowledges the immense help from all his research students in general, and Mr. Jeevanjyoti Chakraborty in particular, for working on various aspects of this book. The editor also acknowledges the continuous mental support that he has been receiving from his parents and his wife, without which this project could have never been materialized. Last but not the least, the editor wishes to dedicate this book to his son, who has first seen the light of the earth on November 20, 2010.

Kharagpur, India Suman Chakraborty



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