

Preface

My early interests in Micromechanics was largely inspired by Professor Toshio Mura. I had been studied under Professor Mura from 1994-1998, during which I had taken his graduate class *Micromechanics* I and II, and I had worked with him in the same office for almost four years. In specific, Professor Mura taught me equivalent eigenstrain theory (which should be labeled as the Eshelby-Mura theory), dislocation theory, and lattice statics/dynamics. As I can remember, one favorite line of Professor Mura's is: *the eigenstrain method is panacea*. My current interests in Nanomechanics and Computational Nanomechanics researches are mainly motivated by my Ph.D. dissertation advisor, Professor Wing Kam Liu, who is one of the leading experts in Computational Nanomechanics today. Readers may find that this book is greatly influenced by Professor Mura's book, *Micromechanics of Defects in Solids* (Kluwer Academic Publisher, 1987) and Professor Liu's book, *Nano Mechanics and Materials: Theory, Multiscale Methods and Applications* (John Wiley & Sons, Ltd., 2005).

Since spring 2001, I have been regularly teaching a graduate course on *Micromechanics* (CE236) in the University of California at Berkeley. This book is the outcome of the lecture notes as well as research projects of that course. In recent years, more focus of the course has been placed on the presentation of nanomechanics — an emerging field that is still very much under development. Therefore, aside from traditional Micromechanics, a unique feature of this book is its in-depth discussions of the latest topics on Nanomechanics and its applications. This includes: lattice Green's function method (LGFM), embedded atom method (EAM), quasi-continuum method, discrete dislocation dynamics (DDD), the Peierls-Nabarro model, the Gurtin-Murdoch surface elasticity model, and the concept of the virial stress, etc.

Many students who had taken the class have participated in the related class research projects. Most of those researches have been published in peer-reviewed journals, and constitute a significant part of materials presented in this book. My co-author, Dr. Gang Wang, is among the first group of students participating in the class research project. Since then, we have been working together for several years, and he has contributed significantly on many subjects discussed in this book.

I would also like to thank those who have made unique contributions to this book. They are: Dr. Roger Sauer, Dr. Christian Linder, Dr. Chin-long Lee, Dr. Xiaohu Liu, Dr. James Foulk III, Dr. Daniel Simkins, Jr., Dr. Elif Ertekin, Dr. Albert To, Dr. Elisa Morgan, Dr. Anurag Gupta, Dr. Ni Sheng, Ms. Veronique Le Corvec, Mr. Morteza Mahyari, Mr. Noang-Nam Nguyen among others.

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The objective of the book is twofold: it can serve as a graduate textbook on Micromechanics and Nanomechanics for the first-year graduate students, and also a research guide book for researchers who want to master the fundamental theories of Micromechanics and Nanomechanics through self-study. One of the main features of this book is to give as many detailed derivations as necessary to assist the readers in understanding the theoretical assumptions, mathematical techniques, and possible limitations. To make the self-learning an enjoyable journey for our readers, our motto is to *spell out all the details even if they may be trivial*. By doing so, we hope to fill the gap between the literature and the actual research notes.

Due to our limitations, the book may contain mistakes, misrepresentations, and errors; Moreover, we are aware the fact that some of the presentations in the book may be biased or limited by our own technical capacities and inadequacies. Readers can send their comments and suggestions to the following email address:

`micro.and.nanomechanics@gmail.com`

which, we hope, can be used to correct and improve the quality of the book in the future.

Finally, we would also like to thank our wives, Yan Zhang (SL) and Furong Wang (GW), and our families. Without their supports and encouragements, this book will never be finished.

Shaofan Li

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