

Preface

The advent of new directions in Electromagnetics (EM) such as nanotechnology, recent advances in high-performance computer technology including the development of highly parallel architectures, and the increasing need to solve large, complex, and real-world problems in a time-efficient manner have prompted the need to develop new Computational Electromagnetics (CEM) techniques for handling such problems. This book is designed to fill the gap in the existing CEM literature by presenting new algorithms for solving a variety of electromagnetic problems of current interest that are not readily amenable to efficient treatment by using the techniques available in the literature.

The book covers a very wide range of subjects under the general umbrella of Computational Electromagnetics (CEM), though its focus is mainly on contemporary topics and recent developments in the field. CEM is a very dynamic field, and despite the fact that there are many existing publications on this topic, it was perceived that there still exists a need for a book that addresses real-world problems arising in the emerging areas of Electromagnetics such as nanotechnology, bio-EM, metamaterials, and multiscale problems, to name a few. The book covers, among others, the topics of computer-aided design of EM systems based on planar circuits; analysis of periodic structures with applications in the design of metamaterials; methods for investigating nanostructures, plasmonics, and quantum effects; solution of multiscale and low-frequency problems; new directions in asymptotic techniques; large-scale domain decomposition and highly scalable parallelization algorithms; higher-order methods for the solution of integral equations; and modeling of radio wave propagation in complex environments.

Putting together this book has been a massive enterprise, and it simply would not have been possible to do it without the cooperation of the contributing authors, to whom I am forever grateful for taking the time out of their busy schedules and sharing with the readers their expertise and knowledge of developing areas of Electromagnetics. I am also thankful to Brett Kruzman and to his editorial and production staff at Springer for guidance provided during the development phase and for ensuring the timely release of the book once the manuscripts were in their hands.

Finally, it is a pleasure for me to acknowledge the help of my assistant, Ms. Jing Feng (Ginni), who managed the project superbly at our end, by keeping all the twenty-odd contributors on track, by assuring on-time delivery of their contributions, and by handling the logistics of this gargantuan task smoothly and highly efficiently.

It is our sincere hope that the readers—be they graduate students, researchers, or practicing engineers—will find the book both interesting as well as useful in their academic enterprises and engineering pursuits. The countless long hours invested by all the contributors in the arduous task of putting this book together would all be “worth it” if that is indeed the case.

May 2013

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Computational Electromagnetics
Recent Advances and Engineering Applications
Mittra, R. (Ed.)
2014, VIII, 704 p. 427 illus., 192 illus. in color.,
Hardcover
ISBN: 978-1-4614-4381-0