

Preface

This textbook is intended for seniors and masters-level graduate students whose studies are in the fields of engineering, physics, or applied mathematics. The intent of this book is to give you an opportunity to come to an understanding of the physical principles and concepts pertinent to the mathematical modeling of soft materials used in engineering practice and to gain competence by applying some basic mathematical techniques to physical problems that arise in the characterization of materials, thereby enhancing your overall understanding and skill level.

This text is not intended to provide lengthy derivations of, e.g., the conservation laws and other such things. Rather, their results are stated and used in an attempt to provide you with an overall understanding of the topic. Advanced derivations and treatments are relegated to graduate courses, for which there are numerous textbooks, some being Bowen (1989), Chadwick (1976), Gurtin (1981), Gurtin et al. (2010), Holzapfel (2000), Lai et al. (1974), Lodge (1964), Ogden (1984), Sokolnikoff (1964), Truesdell and Noll (2004), and Truesdell and Toupin (1960).

Those of you who have studied the calculus up through differential equations and who have had exposure to linear algebra will have sufficient mathematical skills for taking this course. Any other mathematics that you may need will be taught to you along the way. A casual inspection of this text may give you cause for pause, but be assured, the author's intention is to educate you in your understanding of concepts, not in your ability to reproduce derivations and developments. The author's intention is that you enhance your mathematical knowledge by osmosis.

Seven BVPs are studied over the course of this book, each pertaining to an experiment used for material characterization, some classic, some not. Four are done as examples, and three are left for you to learn from.

These seven BVPs are visited at the end of each chapter, applying what you just learned in the current chapter and intermingling it with what you have already learned from prior chapters, thereby extending the development of each experiment and your understanding of them topic by topic. The four worked-out BVPs increase with complexity. The three exercise BVPs left for your development do not require higher-level mathematical skills. All questions are designed to build upon your understanding of the basic concepts and principles that are being taught to you at that particular time.

By the end of the course, your overall exposure to the mathematics involved should make you more comfortable with them. Mathematics is a language, and in this textbook, the author intends that you learn it by immersion rather than by the more wrought and formal approach of lemmas, theorems, and proofs. That can come later, enhanced by your experiences and intuitions gained after taking this primer course.

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