

Preface

Engineers may have different aims and abilities; however, they have a common task: modeling and solving a physical system. In reality, the systems are complex and can only be modeled by nonlinear and coupled equations. Nowadays, even laptops are capable of solving such equations numerically. Therefore, an engineer can model and solve such problems numerically, just by using a laptop.

The underlying work balances between two extremes: being a programmer without duty and being a theoretician without any useful results. The first one, let me call them a *pro*, is able to write an efficient code but *pro* lacks the knowledge of the governing equations. The second one, let me call them a *theo*, believes in the lengthy and complicated equations. *Theo* claims that the humanity cannot comprehend the utmost importance of the theory, but *theo* never performs a useful calculation. An engineer ought to be the fusion of *pro* and *theo*; trying to model and *compute the reality*.

This work aims for one single target: modeling and computing various engineering applications. The theory leading to nonlinear and coupled equations will be discussed and applied by simulating continuum mechanics problems. Open-source packages are utilized for creating a computational reality, where complex engineering problems are solved. Learning by doing is the key concept in this book; theory and practice are served on a silver platter!

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