Preface

This book presents a novel concept for introducing the finite element method, applied in the context of solid mechanics. It presents a major conceptual shift, i.e., taking away lengthy theoretical derivations from the face-to-face interaction with students, focusing on the summary of key equations and concepts and to practice these on well-chosen example problems. The theoretical derivations are provided as additional reading, and students must study and review the derivations in a self-study approach. The theoretical foundation is provided to solve a comprehensive design project in the context of tensile testing. A classical clip-on extensometer serves as the demonstrator on which to apply the provided concepts. The major goal is to derive the calibration curve based on different approaches, i.e., analytical mechanics and based on the finite element method, and to consider further design questions such as technical drawing, manufacturing, and cost assessment. Working with two concepts, i.e., analytical and computational mechanics, strengthens the vertical integration of knowledge and allows the student to compare and understand the different concepts, as well as highlighting the essential need for benchmarking any numerical result. It is beyond question that such an approach can serve only as a first introduction to this powerful and complex method and that further in-depth study is required for a reliable and confident application of the finite element method.

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