Preface

This book is a short introduction to the general-purpose finite element program MSC Marc, which is distributed by the MSC Software Corporation. It is a specialized program for nonlinear problems (implicit solver) which is common in academia and industry. The primary goal of this book is to provide a quick introduction to the software based on simple examples. The documentation of all finite element programs nowadays contains a variety of step-by-step examples of different complexities. In addition, all software companies offer professional workshops on different topics. The intention of this book is not to compete with these professional offers and opportunities. We would rather like to focus on simple examples, often single-element problems, which can easily be related to the theory which is provided in finite element lectures. In that sense, it is rather a companion book to a classical introductory course in the finite element method.

Chapter 1 starts with some historical comments on the development of finite element softwares. Then, a short introduction to the steps of a finite element analysis as well as the graphical interface Mentat is provided. Chapter 2 introduces the simplest one-dimensional element, i.e. a rod which can only deform along its principal axis. The spatial arrangement is then treated to cover more practical problems. Chapter 3 covers simple beam elements which can deform perpendicular to their primary axis. These elements are then arranged as plane frame structures under the consideration of a generalized beam element which can elongate and deflect. Chapter 4 presents a higher order beam theory according to Timoshenko. This formulation considers the contribution of the shear force on the deflection. Chapter 5 extends the rod element to a two-dimensional plane elasticity problem. Chapter 6 introduces the two-dimensional equivalent of the simple beam, a classical plate. Chapter 7 covers three-dimensional elements in the form of hexahedrons. Chapter 8 introduces a nonlinear problem, i.e. the elastoplastic deformation of rod elements. Chapter 9 summarizes a few advanced topics which are helpful for larger simulations or parametric studies.

The instructions provided in this *second edition* of the book relate to the Marc/Mentat 2017.0.0 (64 bit) version (the first edition featured the 2014.0.0 (64 bit) version). The second edition was enriched by further examples and more

explanations to facilitate the interaction with the program. The graphical interface and the command structure might be slightly different for older versions and the reader is, in that case, advised to adjust some of the given instructions. The same must be expected for future versions.

We look forward to receiving some comments and suggestions for the next edition of this introductory work.

Southport, Australia
November 2017

Andreas Öchsner
Marco Öchsner

http://www.springer.com/978-3-319-71914-6

A First Introduction to the Finite Element Analysis
Program MSC Marc/Mentat
Öchsner, A.; Öchsner, M.
2018, XV, 158 p. 88 illus., 43 illus. in color., Hardcover
ISBN: 978-3-319-71914-6