Elements of Scientific Computing

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Preface

Science used to be experiments and theory, now it is experiments, theory and computations. The computational approach to understanding nature and technology is currently flowering in many fields such as physics, mechanics, geophysics, astrophysics, chemistry, biology, and most engineering disciplines. The computational methods used in these branches of science and engineering are very similar. This book is a first introduction to such methods. Many books have been written about this subject. The present one had the overall goal of providing a gentle introduction where the methods are explained through examples taken from various fields of science.

As a computational scientist you will work with other applications, other models, and other methods than those covered in the present text. The field is vast and it is impossible to capture more than a little fraction of it in a reasonably sized text. Therefore, we try to teach principles and ideas. We believe that principles and ideas carry over from field to field, whereas particular clever tricks tend to be application specific. We urge you to try to focus on the ideas and don't get too concerned about the context in which the models appear. We describe the context and provide examples merely in order to simplify the setting and thereby make the text easier to read.

In order to read this text, you will have to know calculus (functions, differentiation, integration etc.), the basics of linear algebra (vectors, matrices etc), and you should be familiar with elementary programming. This is just a gentle start to see what scientific computing is about and get some background that will simplify your future study of more advanced texts on numerical methods and their applications in science and engineering.

All problems in the text have been solved and the solutions are provided on the following web page:

`http://www.ifi.uio.no/cs/`

There you can also find lecture slides for all the chapters in the text.

We hope you enjoy reading it as much as we have enjoyed writing it.

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