

Preface

Why did I write this book?

The approach to engineering design has changed considerably over the last decades.

Earlier, it was of utmost importance to first gain insight into the physics of the problem. You would then try to express the problem in mathematical form. The beauty here was, of course, that it then often was quite simple to determine the location of the extreme values such as the maxima and minima as well as nulls and asymptotic behavior. You would then, in many cases, be able to observe which parameters were pertinent to your problem and in particular which were not. It was then followed by actual calculations and eventually by a meaningful parametric study that took into account what was already observed earlier.

The problem with this approach was, of course, that it required engineers and scientists with considerable insight and extensive training (I deliberately did not say experience, although it helps). However, not everyone that started down this road would finish and not without a liberal dose of humiliation.

It is therefore quite understandable that when the purely numerical approaches appeared on the scene, they soon became quite popular. Most importantly, only a minimum of physical insight was required (or so it was thought). The computers would be so fast that they would be able to calculate all the pertinent cases. These would then be sorted out by using a more or less sophisticated optimization scheme, and the results would be presented on a silver platter completely untouched by the human mind.

It would be incorrect to state that the numerical approach has failed. It has in many cases produced remarkable results. However, the author is keenly aware of several cases that have been the subject of intense investigation for years and still have not produced a satisfactory solution, although some do exist—most often

