

## Preface

Methods for the approximate calculation of definite integrals are covered in every book on numerical analysis. Our intention here is to provide a complementary treatment of this topic by presenting a coherent theory that encompasses many deep and elegant results as well as a large number of interesting (solved and open) problems.

The inclusion of the word “theory” in the title highlights our emphasis on concepts rather than numerical recipes. Thus, no computer programs and only a few numerical examples are given in the book. The focus on theory does not, however, mean that we pass over concrete practical problems, merely that we choose to restrict our attention to problems for which a guaranteed result can be obtained in a systematic manner. Systematic analyses of this kind rely on certain properties of the integrand, over and beyond the knowledge of finitely many function values. Such additional information about the integrand (called “co-observations”) forms the central organizing principle for our theory, and distinguishes our book from other texts on quadrature. A wide variety of co-observations are examined in this monograph, as we believe such information will be very useful for solving problems in practical contexts.

While quadrature theory is often viewed as a branch of numerical analysis, its influence extends much further: it has been the starting point of many far-reaching generalizations in various directions, as well as a testing ground for new ideas and concepts; in fact, in many instances the extensions seem more “natural” than the original motivating problem. We shall discuss such generalizations, although the classical problem will remain our guiding star throughout the book.

Working on quadrature has given us great pleasure over the years, and we hope we can convey our enthusiasm for the subject to the readers of this book.

The mathematical prerequisites for engaging with this text are knowledge (at the level taught in most undergraduate courses) of linear algebra, advanced calculus and real analysis.

We thank our wives for their patience and assistance in many ways.

We are grateful to Alice Yew for her help in editing our manuscript.

Helmut Brass and Knut Petras  
Technische Universität Braunschweig