

Preface

This book is my fifth volume on engineering mathematics, following *Notes on Vector Field Theory* (Science Press, 2007), *Notes on Complex Variable Function* (Science Press, 2011), *Notes on Matrix Theory* (Science Press, 2014), and *Notes on Probability Theory* (Science Press, 2014). Although each note touches on a completely different field, *they all serve the same goal: endeavoring to build a bridge between mathematics and engineering while bringing about benefits for readers in their future learning and work.*

The core theme of the book is ellipsoid function, which serves as an extension of the existing circular function (trigonometric function) and elliptic function. If circular function, elliptic function and ellipsoidal function are compared to three peaks, each of which is higher and more magnificent than the preceding one.

Ellipsoid function belongs to the special function field. The mention of special function would discourage a good many readers due to its abstraction and complexity. The first feature of the book, or the most striking one, is the elicitation of the most complicated ellipsoid function from the most practical and specific application examples. Moreover, the book begins with the discussion from the elliptic integral.

Ellipsoid integrals fall into two categories. Here we take the first category as the example. Circular integral corresponds to the capacitance of the circular disk conductor; elliptic integral of the first kind corresponds to the capacitance of the elliptic disk conductor; while ellipsoid integral of the first kind corresponds to the capacitance of the ellipsoidal conductor. This form of discussion is accessible and concrete, with each being encompassed by another, namely:

Ellipsoid integral of the first kind

Elliptic integral of the first kind

Circular integral

Let us consider the second category of ellipsoid integrals. Circular integral corresponds to the perimeter of a circle; elliptic integral of the second kind corresponds to the perimeter of an ellipse; and ellipsoid integral of the second kind

corresponds to the surface area of an ellipsoid. It is obvious that each of them encompasses another as well, namely:

Ellipsoid integral of the second kind

Elliptic integral of the second kind

Circular integral

The second feature of the book is the close combination of algebra and geometry. The book discusses the ellipsoid function (algebra) theory and conformal mapping (geometry) theory of the ellipsoid function in exhaustive detail. The latter is the complex geometry theory of ellipsoid function as opposed to the ordinary geometrical theory, which creates the most illustrative background for the application of the function.

The third feature of the book, namely the major goal of engineering mathematics, is the application to solving practical engineering problems. In the book, I set up the ellipsoid function network and three-band filter (pass band, transition band and attenuation band) model, ultimately producing an ellipsoid function filter with outstanding performance through concrete examples. In other words, we delineate the path that engineering mathematics should take, using the ellipsoid function as the example.

Additionally, I take the liberty of discussing the core idea of the serial books. Entrepreneurship, innovation, and creation have become very fashionable terms. However, it should be pointed out that they are not just a form of empty talk or an ornament. Instead, they represent the attitude, ambition, and persistence that we should hold and bear in mind. Innovation is valuable, regardless of whether it is big or small. I happened to follow the idea in writing the series of books. This is also true of, for example, vector division, complex operator, and polarization networks. Open ideas, varied contents, and popular characters are my constant pursuits in writing the books.

Despite my painstaking efforts, it is inevitable that there might be some shortcomings in the book. Therefore, I sincerely hope that experts and readers can make comments and corrections to further enhance the quality of the serial books.

Finally, I extend my heartfelt thanks to Prof. Pei-Heng Wu, a respected member of Chinese Academy of Sciences, for his help and preface to the book.

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