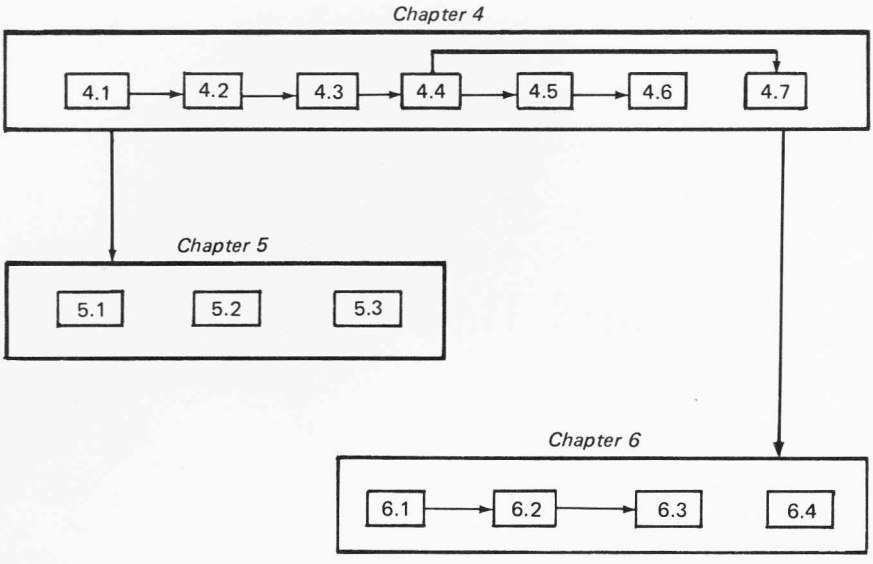
Part II

Fourier and Bessel Series

This part presents the expansion of functions on finite intervals in series of oscillating exponentials or in Bessel functions. Applications include the description of diffusion and elastic media with periodic or fixed boundary conditions.

Chapter 4 reviews the relevant aspects of function vector spaces and covers Fourier series. The first four sections present the basic Dirichlet theorem on existence and convergence of the Fourier series and their main properties with a stress on transformation operators. The Dirac δ and its derivatives, their divergent series representations, as well as a physicist's guide to operators and infinite matrix representatives, are given in the last two sections. These methods are then applied in Chapter 5 to heat diffusion in a ring, the vibrating string, and the infinite lattice. For each, we find its Green's functions, fundamental solutions, and normal modes. The last are particularly useful when describing, in Chapter 6, the vibrations of two- and higher-dimensional elastic membranes or cavities. Normal mode expansions for regions with circular boundaries give rise to Bessel and related series. The last section of this chapter gives a sketch of other series which appear in mathematical physics. The two chapters with applications, 5 and 6, are independent. The first serves to illustrate the uses of the Dirac δ (Section 4.5) and the second those of eigenbasis expansions (Section 4.6).


Chapter 4
4.1
4.2
4.3
4.4
4.5
4.6
4.7
Chapter 5
5.1
5.2
5.3
Chapter 6
6.1
6.2
6.3
6.4