Literature

There is an overwhelming amount of literature available on Fourier and Laplace transforms. In it, one can roughly distinguish two main trends. On the one hand the theoretical literature for a mathematically oriented audience, on the other hand the literature where the applications play a central role. In much of the literature aimed at the applications, the results are presented without precise conditions or proofs. The mathematical literature, however, is mostly of a very theoretical nature and assumes quite a lot of prerequisites, such as the so-called Lebesgue integral. In the following survey one will find very few books from the latter category. A number of the books mentioned below do require a mathematical background which goes beyond what we have assumed for this book. Two rather elementary standard books on mathematical analysis, which could be consulted in order to obtain the required background, are for example (these books are available in several editions):

Apostol, T.M., *Mathematical analysis.* Reading, Addison-Wesley, 1957.
Kaplan, W., *Advanced calculus.* Boston, Addison-Wesley, 1984, 3rd ed.

We do hope that the books listed here offer a good opportunity for a more elaborate study of the many different aspects of both the theory and the applications of the Fourier and Laplace transforms.

Bracewell, R.N., *The Fourier transform and its applications.* New York, McGraw-Hill, 1986, 2nd ed., revised.

A real classic (the first edition is from 1965), and generally considered as one of the standard works in the field of the applications of the Fourier integral, especially in signal theory. More specifically, it contains applications to filters, sampling, convolution, imaging (antennas and television), and sound (noise). The discrete Fourier transform and the Fast Fourier Transform (FFT) are also treated extensively.

Brigham, E.O., *The fast Fourier transform.* Englewood Cliffs, Prentice-Hall, 1974.

After a rather sketchy treatment of the Fourier integral and convolution, the determination of the discrete Fourier transform using the FFT is then treated very thoroughly. This book is a standard work on the FFT.

Churchill, R.V. and J.W. Brown, *Fourier series and boundary value problems.* New York, McGraw-Hill, 1978, 3rd ed.

Applying Fourier analysis to boundary value problems (see sections 5.2 and 10.4) is the central issue. Although emphasis is put on Fourier series, more general series of orthogonal functions and the Fourier integral are treated as well.

Doetsch, G., *Einführung in Theorie und Anwendung der Laplace Transformation.* Basel, Birkhäuser Verlag, 1958 (in German).
Doetsch, G., *Guide to the applications of Laplace transforms.* London, Van Nostrand, 1961.

The book mentioned first gives a very thorough treatment of the Laplace transform. Although only the Riemann integral is used, this book does assume a solid mathematical background. The Laplace transform of distributions is also treated, but it is assumed that the reader is familiar with the theory of distributions. Applications to differential equations are treated extensively. The second book is in fact a very compact version of the first one. The most relevant results are given without proof. The book then concentrates on the applications to differential and difference equations.

Dym, H. and H.P. McKean, *Fourier series and integrals.* New York, Academic Press, 1972.

This book requires a good mathematical background and uses the so-called Lebesgue integral (the only book in this survey which does), although this theory is explained in the first chapter. We mention this book mainly because it is considered as one of the standard works as far as the theory of Fourier series and Fourier integrals is concerned. It also contains a whole range of applications of Fourier analysis in mathematics and physics.

Enden, A.W.M. van den and N.A.M. Verhoeckx, *Digitale signaalbewerking.* Overberg (gem. Amerongen), Delta Press, 1987 (in Dutch).

This book (in Dutch) treats in a well-organized manner discrete systems and several discrete transforms. The theory is then applied to the design of discrete filters. Moreover, problems are discussed that arise when processing signals of finite word length. These are discrete signals whose *values* are discrete as well. The book is clearly aimed at the applications. The style is clear and it points the reader at important aspects of several of the transforms. Mathematical rigour is comparable to what is normally seen in mathematics books for engineers. When studying part 5 of our book, van den Enden and Verhoeckx is recommended to those who are interested in the style of the people who apply this material.

Hanna, J. and J.H. Rowland, *Fourier series, transforms and boundary value problems.* New York, Wiley, 1990.

A clearly written introduction to partial differential equations, mainly aimed at students in the technical sciences and engineering. Clear physical motivations are given of the equations under consideration, as well as of the interpretations of the obtained solutions. One also discusses, for example, existence and uniqueness of the solutions of the heat equation and the wave equation at an elementary level.

Körner, T.W., *Fourier analysis.* Cambridge, Cambridge University Press, 1990.

A book covering a wide variety of subjects and consisting of some hundred short chapters ('essays'). Alternately the theories of Fourier series and the Fourier integral are developed and a large number of different applications is treated (a small sample: approximation, the age of the earth, the transatlantic cable, the heat equation).

Papoulis, A., *Circuits and systems.* New York, Holt, Rinehart & Winston, 1980.

Of the large number of books on linear systems we only mention here this well-known book by Papoulis. It is quite comprehensive and treats both analogue and digital systems, and all transforms treated by us occur in it (Laplace transform, z-transform, Fourier series, Fourier integral, discrete Fourier transform, and FFT). There is a strong emphasis on the practical applications in electrical circuits and networks.

Papoulis, A., *Signal analysis.* Singapore, McGraw-Hill, 1984.

Again we only mention the book by Papoulis as one of the standard works in the vast amount of literature on signal analysis. Again all transforms treated by us occur

in it. Here there is a strong emphasis on the applications in signal analysis: filters, windowing and data smoothing are some of the main subjects.

Senior, T.B.A., *Mathematical methods in electric engineering.* Cambridge, Cambridge University Press, 1986.

In this book the emphasis is on the Laplace transform and the applications to systems theory. The theory of complex functions, necessary in order to use the fundamental theorem of the Laplace transform (see section 13.5), is treated extensively. Besides this, Fourier series and the Fourier integral are treated in some detail.

Spiegel, M.R., *Schaum's outline of theory and problems of Fourier analysis with applications to boundary value problems.* New York, McGraw-Hill, 1976.
Spiegel, M.R., *Schaum's outline of theory and problems of Laplace transforms.* New York, McGraw-Hill, 1965.

These are two books from the well-known 'Schaum's outline' series. After a short summary of the most well-known results from the theory and the applications, worked examples follow, together with a large number of exercises. In the first book the emphasis is on Fourier series, the Fourier integral and the applications to boundary value problems (as in the previously mentioned book by R.V. Churchill and J.W. Brown). In the second book the emphasis is on the Laplace transform and the application to differential equations. Complex function theory is also treated briefly. Part of the material on Fourier series and the Fourier integral from the first book can also be found in the second book. These books are very suitable as practising material.

Tolstov, G.P., *Fourier series.* New York, Dover, 1962.

This book is mainly devoted to a thorough treatment of the theory of the Fourier series. Still, it is of an elementary character, meaning that one can read it with a minimum of mathematical prerequisites. Besides Fourier series, the Fourier integral is treated briefly, as well as other series of orthogonal functions.

Walker, P.L., *The theory of Fourier series and integral.* Chicester, Wiley, 1986.

One of the few books on Fourier series and the Fourier integral in this survey with a theoretical character, but which does not use the so-called Lebesgue integral. Therefore, this book is also intended for engineering students.

Zemanian, A.H., *Distribution theory and transform analysis.* New York, Dover, 1987.

It is quite hard to find an elementary book on distribution theory. This book contains a very comprehensive treatment of the distribution theory that is still very accessible. Besides the general theory, both the Fourier transform and the Laplace transform of distributions are treated.