

**ZMATH 2011b.01123****Duffy, Dean G.****Advanced engineering mathematics.**

Boca Raton, FL: CRC Press. 634 p. (1998).

This is a very good book on advanced engineering mathematics. The difference between this book and earlier ones on the same topic is that the author has shown the exact application of the theory in practical applications, e.g. 1) The problem of inlet system of a four stroke engine has been solved with the help of Fourier series, 2) the application of the Fourier transform in the study of radiative heat transfer is also discussed based on a paper published in 1972, 3) the application of the  $Z$ -transform in computing compound interest is an excellent example and there are many such interesting examples from practical engineering that are solved by different mathematical techniques. Another important and interesting aspect of this book, which I never found in any book of similar type at advanced level is the printing of photographs of eminent mathematicians who contributed to this theory e.g. Cauchy (1789-1857), Riemann (1826-1866), Fourier (1768-1830), Dirichlet (1805-1859), Heavyside (1850-1925), Bromwich (1875-1929), Legendre (1752-1833), Bessel (1784-1846), d'Alembert (1717-1783), Poisson (1781-1840) Stokes (1819-1903) Sturm (1803-1855), Liouville (1809-1882), Gauss (1777-1855). The author has given a short description of their contributions to the development of different theories and their applications. In fact, long back, I read about the lives of these mathematicians in a book [*E. T. Bell, Men of mathematics. I, II* (London 1953)]. But this was a general description of the contribution by these mathematicians to the development of mathematics. A graduate student will be glad to see these additional informations. The book is divided into 11 chapters as follows: 1. Complex variables: A brief introduction is given with emphasis on residue theory which is most useful in deriving inversion of functions in Fourier, Laplace,  $Z$ -transforms, etc. 2. In Ch. 2, 3, 4 the theory of Fourier series, Fourier transform, and Laplace transform is discussed and their application to the solution of ordinary differential equations in different branches of engineering is given. 3. In Ch. 5,  $Z$ -transform theory, its relation to the Laplace transform theory is briefly discussed. The most important application of this transform is to solve a single or a system of difference equations, in finance (to solve compound interest problems). Usually difference equations are solved on a computer where we have to discuss the stability of the finite difference scheme. Here it is shown that the  $Z$ -transform helps us to study the stability of the discrete time system. Ch. 6 deals with the well known Sturm-Liouville problems. Here basic theories are discussed, a good number of problems are solved and this whole theory is based on the assumption of a regular Sturm-Liouville problem. Later on, the theory of singular Sturm-Liouville problem is studied and its relation to the Legendre and Bessel equations are established and then some of the Legendre and Bessel functions are discussed. Some examples are given in the exercises. Ch. 7 is devoted to the wave equation. The solution of the wave equation under different conditions is discussed. Separation of variables and Laplace transform methods are used to derive some physical problems. In many cases, these analytical methods fail and we have to employ the finite-difference technique which is discussed in short. Ch. 8 is devoted to the one-dimensional heat equation: the method of separation of variables, the transform methods and the numerical method are used to solve the actual physical problems of importance. Steady state heat transfer phenomenon is governed by Laplace and Poisson equations. All three methods of solution discussed in Ch. 8 are employed to solve these equations in Ch. 9. A short account of vector calculus and linear algebra is presented in the last two chapters 10 and 11. This will help the teacher to introduce these techniques to a graduate student. Simple examples of finding the eigenvalues and corresponding eigenfunctions are solved, which will help the engineering graduates to develop these further in their engineering branches. In general, the reviewer is quite happy to see such an interesting book that should be recommended as a textbook at graduate level in engineering schools. It is a really interesting and useful book that tries to discuss the actual physical problems.

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