

Bessel Functions and Their Applications: Solution to Schrödinger equation in a cylindrical function of the second kind and Hankel Functions

¹Faisal Adamu Idris, ²Aisha Layla Buhari, ³Tahir Usman Adamu

^{1,2,3}Jodhpur National University, Rajasthan, India.

Abstract: Bessel functions are a series of solutions to a second order differential equation that arise in many diverse situations. Develops the different kinds of Bessel functions and explores the topic of zeroes. In a solution of a free particle (zero potential) time-independent Schrodinger equation as applied to cylindrical function of the second kind (Neumann functions) and cylindrical function of third kind (Hankel functions of first and second kind), we would see that the solution in each case which is present in the solution of Bessel differential equation are the same.

Keywords: Bessel Equation, Bessel Functions, Modified Bessel Equation, Modified Bessel Functions, Neumann Function, Hankel Functions, Schrodinger Equation.

1. INTRODUCTION

Bessel function were studied by Euler, Lagrange and the Bernoulli. The Bessel functions were first used by Friedrich Wilhelm Bessel to explain the three body motion, with the Bessel function which emerge in the series expansion of planetary perturbation. Bessel function are named for Friedrich Wilhelm Bessel (1784-1846), after all, Daniel Bernoulli is generally attributed with being the first to present the idea of Bessel functions in 1732. He used the function of zero order as a solution to the problem of an oscillating chain hanging at one end. By the year 1764, Leonhard Euler employed Bessel functions of both the integral orders and zero orders in an analysis of vibrations of a stretched membrane, a research that was further developed(refined) by Lord Rayleigh in 1878, where he proved that Bessel functions are particular case of Laplace functions (Niedziela,2008). The Bessel function was the result of Bessel study of a problem of Kepler for determining the motion of three bodies moving under mutual gravitation. In 1824, he incorporated Bessel functions in a study of planetary perturbations where the Bessel functions appear as coefficients in a series expansion of the indirect perturbation of a planet, that is the motion of the Sun caused by the perturbing body.

Bessel's differential equation arises as a result of determining separable solutions to Laplace's equation and the Helmholtz equation in spherical and cylindrical coordinates. Therefore, Bessel functions are of great important for many problems of wave propagation and static potentials.

In 1926, Erwin Schrödinger as a result of his interest by the de Broglie hypothesis created an equation as a way of expressing the wave behavior of matter particle, for example, the electron. The equation was later named as Schrödinger equation which can be written as:

$$\left(\frac{-\hbar^2}{2m} \nabla^2 + U(r, t) \right) \psi(r, t) = i\hbar \psi(r, t)$$

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Bessel Functions and Their Applications B G Korenev,2002-07-25 Bessel functions are associated with a wide range of problems in important areas of mathematical physics Bessel function theory is applied to problems of acoustics radio physics hydrodynamics and atomic and nuclear physics Bessel Functions and Their Applications consists of two parts In Part One the author presents a clear and rigorous intro Normal and Student's t Distributions and Their Applications Mohammad Ahsanullah,B.M. Golam Kibria,Mohammad Shakil,2014-02-07 The most important properties of normal and Student t distributions are presented A number of applications of these properties are demonstrated New related results dealing with the distributions of the sum product and ratio of the independent normal and Student distributions are presented The materials will be useful to the advanced undergraduate and graduate students and practitioners in the various fields of science and engineering *Stochastic Methods and their Applications to Communications* Serguei Primak,Valeri Kontorovich,Vladimir Lyandres,2005-01-28 Stochastic Methods their Applications to Communications presents a valuable approach to the modelling synthesis and numerical simulation of random processes with applications in communications and related fields The authors provide a detailed account of random processes from an engineering point of view and illustrate the concepts with examples taken from the communications area The discussions mainly focus on the analysis and synthesis of Markov models of random processes as applied to modelling such phenomena as interference and fading in communications Encompassing both theory and practice this original text provides a unified approach to the analysis and generation of continuous impulsive and mixed random processes based on the Fokker Planck equation for Markov processes Presents the cumulated analysis of Markov processes Offers a SDE Stochastic Differential Equations approach to the generation of random processes with specified characteristics Includes the modelling of communication channels and interferences using SDE Features new results and techniques for the of solution of the generalized Fokker Planck equation Essential reading for researchers engineers and graduate and upper year undergraduate students in the field of communications signal processing control physics and other areas of science this reference will have wide ranging appeal **A Treatise on Bessel Functions and Their Applications to Physics** Andrew Gray,George Ballard Mathews,1895 **The Fascination of Probability, Statistics and their Applications** Mark Podolskij,Robert Stelzer,Steen Thorbjørnsen,Almut E. D. Veraart,2015-12-26 Collecting together twenty three self contained articles this volume presents the current research of a number of renowned scientists in both probability theory and statistics as well as their various applications in economics finance the physics of wind blown sand queueing systems risk assessment turbulence and other areas The contributions are dedicated to and inspired by the research of Ole E Barndorff Nielsen who since the early 1960s has been and continues to be a very active and influential researcher working on a wide range of important problems The topics covered include but are not limited to econometrics exponential families Levy processes and infinitely divisible distributions limit theory mathematical

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