## Bessel Functions and their Applications

**B.G. Korenev** 



A CRC Press Company Boca Raton London New York Washington, D.C.

## Contents

••

Preface		vll
Introduction		
Part 1	. Foundation of the theory of Bessel functions	5
Chapte	r 1. The Bessel equation. Properties of Bessel functions	7
	The Bessel differential equation. Application of power series. Cylindrical	1
	functions of the first kind	7
2. (	Cylindrical functions of the second kind (Neumann functions)	10
3. (	Cylindrical functions of the third kind (Hankel functions)	11
4. (	Cylindrical functions of a pure imaginary argument	11
5. (	Cylindrical functions of a complex argument	12
6. J	Formulae of differentiation, recurrence relations	14
7. (	Cylindrical functions with a half-integer index	16
8. 5	Some notation for functions of half-integer and fractional index. Airy	
	integral	17
9. 1	Wronski determinant	19
10.	Bessel integral and Jacobi expansion	22
11.		26
12.	Lommel expansion	31
13.	• •	31
14.	The Poisson integral	37
15.	Some indefinite integrals	40
16.	Functions contiguous to Bessel functions. Particular solutions of the	
	inhomogeneous Bessel equation	43
17.	On integration of the inhomogeneous Bessel equation. Cauchy functions	50
18.	Products of Bessel functions	56
19.	Integral representations of Bessel functions	59
Chapte	r 2. Definite and improper integrals. Series in Bessel functions	65
<b>20</b> .	Definite integrals	65
21.	Improper integrals	69
22.	Dual integral equations	87
23.	Roots of the Bessel functions	93
24.	Series of Fourier-Bessel and Dini	96
<b>25</b> .	Schlömlich series	104
<b>26</b> .	Neumann series	113
27.	Lommel functions of two variables	114

v

CONTENTS

<b>28</b> .	On partial cylindrical functions	120		
<b>29</b> .	Asymptotic expansion of Bessel functions	125		
30.	On Bessel functions with a large index	128		
<b>D</b>				
Part 2	. Applications of Bessel functions	131		
Chapter 3. Problems of the theory of plates and shells		133		
31.	Oscillations and stability of a circular plate	133		
32.	Equilibrium of a circular plate lying on an elastic foundation. Axially	,		
	symmetrical deformation	155		
33.	Equilibrium of a circular plate lying on an elastic foundation. Non-			
	axially symmetrical deformation	162		
34.	Calculation of a circular conic shell under the action of axially symmetrie			
	loadings and non-uniform heating	170		
35. The method of compensating loadings in problems on membranes and				
	plates	184		
36.	The problem on equilibrium of an unbounded plate which lies on a uniform elastic foundation whose model has a circular symmetry	208		
Chapter 4. Problems of the theory of oscillations, hydrodynamics and heat				
	transfer	215		
37.	On the oscillations of a thread	215		
38.	Stability and transverse-longitudinal bending of a rectilinear rod;			
	stability of the plane form of the bending of a strip	219		
39.	Plane heat waves in a half-space and a layer; heat waves in a rod	241		
40.	A die which lies on an elastic half-space whose modulus of elasticity is			
	a power function of the depth	247		
41.	41. Application of integral equations to the solution of some problems on			
	membranes and plates	250		
42.		256		
<b>43</b> .	The action of an impulse on cylindrical and prismatic tanks filled with			
	a fluid	257		
Append	dix A. Brief information on gamma functions	265		
Bibliographical notes		267		
Bibliography ,		271		
Index		275		

ř

vi