METHODS BASED ON THE WIENER-HOPF TECHNIQUE

for the solution of partial differential equations

by

B. NOBLE

Senior Lecturer in Mathematics
The Royal College of Science and Technology
Glasgow

CHELSEA PUBLISHING COMPANY NEW YORK, N. Y.

CONTENTS

		PAGE
Pref	ace	vii
Som	e basic notation and results from Chapter I	x
Ι	. COMPLEX VARIABLE AND FOURIER TRANSFORM	MS
1.1	Introduction	I
1.2	Complex variable theory	5
1.3	Analytic functions defined by integrals	11
1.4	The Fourier integral	21
1.5	The wave equation	27
1.6	Contour integrals of a certain type	31
1.7	The Wiener-Hopf procedure	36
	Miscellaneous examples and results I	38
	II. BASIC PROCEDURES: HALF-PLANE PROBLEMS	8
2.1	Introduction	48
2.2	Jones's method	52
2.3	A dual integral equation method	58
2.4	Integral equation formulations	61
2.5	Solution of the integral equations	67
2.6	Discussion of the solution	72
2.7	Comparison of methods	76 77
$\frac{2.8}{2.9}$	Boundary conditions specified by general functions	77 83
2.9	Radiation-type boundary conditions Miscellaneous examples and results II	86
	•	00
	III. FURTHER WAVE PROBLEMS	
3.1	Introduction	98
3.2	A plane wave incident on two semi-infinite parallel planes	100
3.3	Radiation from two parallel semi-infinite plates	105
$\begin{array}{c} 3.4 \\ 3.5 \end{array}$	Radiation from a cylindrical pipe Semi-infinite strips parallel to the walls of a duct	110 118
3.6	A strip across a duet	122
3.0	Miscellaneous examples and results III	125
ττ	V. EXTENSIONS AND LIMITATIONS OF THE METH	OD
$4.1 \\ 4.2$	Introduction The Hilbert problem	141 141
4.3	General considerations	147
4.4	Simultaneous Wiener-Hopf equations	153
4.5	Approximate factorization	160
4.6	Laplace's equation in polar co-ordinates	164
-	Miscellaneous examples and results IV	167

	٠
37	3
v	1

CONTENTS

V. SOME APPROXIMATE METHODS

5.1	Introduction	178
5.2	Some problems which cannot be solved exactly	180
5.3	General theory of a special equation	184
5.4	Diffraction by a thick semi-infinite strip	187
5.5	General theory of another special equation	196
5.6	Diffraction by strips and slits of finite width	203
	Miscellaneous examples and results V	207
	VI. THE GENERAL SOLUTION OF THE BASIC WIENER-HOPF PROBLEM	
6.1	Introduction	220
6.2	The exact solution of certain dual integral equations	222
	Miscellaneous examples and results VI	228
Bibliography		237
Index		243