

Contents

Preface — V

1	Classification of second-order partial dynamic equations — 1
1.1	Classification — 1
1.2	Classical solutions — 9
1.3	Advanced practical problems — 21
1.4	Notes and references — 23
2	Classification and canonical forms for linear second-order partial dynamic equations in two independent variables — 24
2.1	Classification — 24
2.2	The hyperbolic case — 32
2.3	The elliptic case — 38
2.4	The parabolic case — 49
2.5	The method of characteristics — 57
2.6	Advanced practical problems — 65
2.7	Notes and references — 67
3	The Laplace transform method — 68
3.1	Definition of the Laplace transform: properties — 68
3.2	Decay of the exponential function — 81
3.3	Convergence of the Laplace transform — 88
3.4	Inversion of the Laplace transform — 91
3.5	Differentiation of the Laplace transform — 93
3.6	Applications to second-order partial dynamic equations — 99
3.7	Advanced practical problems — 109
3.8	Notes and references — 111
4	The Fourier transform method — 113
4.1	The Fourier transform — 113
4.2	The Fourier transform method for second-order partial dynamic equations — 149
4.3	Advanced practical problems — 151
4.4	Notes and references — 153
5	Method of separation of variables — 154
5.1	First eigenvalue problem — 154
5.2	Second eigenvalue problem — 183

5.3	Third eigenvalue problem —	193
5.3.1	Lebesgue-type measure and integration over \mathbb{T} —	193
5.3.2	The spaces $\mathbb{L}^p(\mathbb{T})$ —	196
5.3.3	Sobolev-type spaces and generalized derivatives —	199
5.3.4	A weighted eigenvalue problem —	214
5.4	Method of separation of variables for second-order partial dynamic equations —	235
5.5	Advanced practical problems —	258
5.6	Notes and references —	261
6	Method of factoring —	262
6.1	Method of factoring for second-order partial dynamic equations —	262
6.2	Method of factoring for higher-order partial dynamic equations —	277
6.3	Advanced practical problems —	292
6.4	Notes and references —	293
7	The wave equation —	294
7.1	Introduction —	294
7.2	The Cauchy problem for the homogeneous wave equation —	294
7.3	The Cauchy problem for the nonhomogeneous wave equation —	301
7.4	Advanced practical problems —	316
7.5	Notes and references —	317
8	The heat equation —	318
8.1	The weak maximum principle —	318
8.2	Particular solutions —	321
8.3	Advanced practical problems —	342
8.4	Notes and references —	343
9	The Laplace equation —	344
9.1	The weak maximum principle for the Laplace equation —	344
9.2	The Poisson equation —	347
9.3	Advanced practical problems —	349
9.4	Notes and references —	350
10	Reduction of some partial dynamic equations —	351
10.1	Reduction to the heat equation —	351
10.2	Reduction to the wave equation —	354
10.3	Reduction to the Laplace equation —	356
10.4	Advanced practical problems —	358
10.5	Notes and references —	359

Bibliography — 361

Index — 363