

Contents

	<i>Preface</i>	page vii
	<i>Acknowledgements</i>	ix
1	Wave fundamentals	1
	1.1 Definitions	1
	1.2 Basic relationships	6
	1.3 Vector concepts	9
	1.4 Complex numbers	14
	1.5 Euler relations	23
	1.6 Wavefunctions	26
	1.7 Phasor representation of wavefunctions	33
	1.8 Problems	43
2	The wave equation	44
	2.1 Partial derivatives	44
	2.2 The classical wave equation	53
	2.3 Properties of the wave equation	59
	2.4 PDEs related to the wave equation	69
	2.5 Problems	74
3	Wave components	75
	3.1 General solutions to the wave equation	75
	3.2 Boundary conditions	80
	3.3 Fourier theory	94
	3.4 Wave packets and dispersion	116
	3.5 Problems	123
4	The mechanical wave equation	124
	4.1 Properties of mechanical waves	124

4.2	Waves on a string	126
4.3	Pressure waves	134
4.4	Energy and power of mechanical waves	141
4.5	Wave impedance, reflection, and transmission	149
4.6	Problems	161
5	The electromagnetic wave equation	162
5.1	Properties of electromagnetic waves	162
5.2	Maxwell's equations	165
5.3	Electromagnetic wave equation	168
5.4	Plane-wave solutions to the electromagnetic wave equation	171
5.5	Energy, power, and impedance of electromagnetic waves	178
5.6	Problems	184
6	The quantum wave equation	185
6.1	Wave and particle characteristics	185
6.2	Wave–particle duality	189
6.3	The Schrödinger equation	194
6.4	Probability wavefunctions	199
6.5	Quantum wave packets	200
6.6	Problems	213
	<i>References</i>	214
	<i>Index</i>	215