

CONTENTS

Preface to Second Edition	ix
---------------------------------	----

Preface to First Edition	xiii
--------------------------------	------

1.	Introduction - Properties of Materials.....	1
	1.1 Conventional Materials.....	2
	1.2 Elasticity Theory	16
	Problems	36
2.	Physical Factors Influencing Mechanical Properties.....	40
	2.1 Strength of Solids Calculated from Bond Strengths.....	40
	2.2 Dislocations	47
	2.3 Notches and Cracks	51
	2.4 Practical Limits for Strength.....	61
	Problems	64
3.	Fibres, Whiskers, and Platelets.....	66
	3.1 Slender Forms of Material	66
	3.2 Polymer Fibres and Metal Wires.....	69
	3.3 Inorganic Fibres and Whiskers.....	74
	3.4 Single Crystal Platelets.....	86
	3.5 Forms of Reinforcement.....	87
	Problems	93
4.	Composite Mechanics: Long Fibres.....	95
	4.1 Axial Modulus and Strength.....	95
	4.2 Off Axis Properties	99
	4.3 Laminae	104
	4.4 Laminates	116
	4.5 Random Fibre Structures	138
	Problems	141
5.	Composite Mechanics: Short Fibres.....	144
	5.1 Elastic Stress Transfer.....	145
	5.2 Elastic Stress-Strain Relationships.....	151
	5.3 Composite Strength.....	155
	5.4 Misorientation Effects	165
	5.5 Variable Fibre Length	169
	Problems	171
6.	Matrix Dominated Properties.....	173
	6.1 Shear Failure Processes in the Matrix.....	173
	6.2 Internal Structures in Composites: the Mesostructure.....	183
	6.3 Transverse Properties.....	186
	6.4 Shear Strengths	195
	6.5 Compressive Strengths.....	200
	6.6 Fatigue Endurance	217
	Problems	220

7.	Brittle Fracture Processes.....	222
	7.1 Fracture Mechanics.....	223
	7.2 Through Thickness Fracture.....	230
	7.3 Delamination Fracture.....	240
	7.4 Inhibition By Fibres of Matrix Plastic Work	242
	7.5 Impact Damage Evaluation.....	244
	Problems	248
8.	Interface Mechanics and Testing.....	251
	8.1 Properties Sensitive to Interface Strength.....	251
	8.2 Direct Measurement of Interface Strength.....	252
	8.3 Problems with Direct Interface Measurements	256
	8.4 Work of Fibre Pull Out in Composite Fracture.....	284
	8.5 Non Axisymmetric Tests.....	289
	8.6 Conclusions	297
	Problems	299
9.	Reinforcement of Polymers	301
	9.1 The Polymers.....	301
	9.2 The Interface.....	315
	9.3 Premixes	316
	9.4 Manufacturing Methods.....	317
	Problems	329
10.	Reinforced Polymer Properties	330
	10.1 Mechanical Properties.....	331
	10.2 Fatigue	338
	10.3 Creep.....	346
	10.4 Environment Effects	347
	10.5 Hybrid Composites	366
	10.6 Joints.....	371
	Problems	376
11	Other Fibre Composites	379
	11.1 The Thermal Contraction Problem	380
	11.2 Advantages and Drawbacks of Reinforced Metals.....	387
	11.3 Manufacture of Reinforced Metals	388
	11.4 Properties of Reinforced Metals	396
	11.5 Joints.....	407
	11.6 Reinforcement of Ceramics	408
	11.7 Reinforced Ceramics Properties	416
	11.8 Reinforced Cements and Plasters.....	423
	Problems	425
12	Applications	428
	12.1 Aerospace Structures.....	429
	12.2 Marine Structures.....	435
	12.3 Ground Transport	438
	12.4 Energy and Storage	439
	12.5 Pipelines and Chemical Plant	441
	12.6 Infrastructure.....	443
	12.7 Medical Applications	445
	12.8 Sports Equipment	447
	12.9 Other Uses	448

Problems	453
Appendices	456
A. Symbols used in Text	456
B. Acronyms and Abbreviations.....	461
C SI Units.....	463
Index	466