

Contents

Preface	v
Chapter 1. Thermal Stresses in Plates – Dynamical Problems	
by <i>Theodore R. Tauchert</i>	1
1. Introduction	2
2. Thermoelastic theory for plates	3
3. Solutions to coupled problems.	11
4. Solutions to uncoupled problems	17
5. Anisotropic and heterogeneous plates	28
6. Additional topics	38
References	54
Chapter 2. Thermal Stress Singularities	
by <i>Hideki Sekine</i>	57
1. Preface	58
2. Introduction.	58
3. Basic formulas of two-dimensional theory of thermoelasticity	60
4. Temperature dislocations, heat sources, edge dislocations, and concentrated forces	65
5. Crack problems	70
6. Flat inclusion problems	86
7. Thin stiffener problems	106
Appendix A. Transformation formulas of elastic potential functions under translation and rotation of rectangular coordinate systems.	112
Appendix B. Expressions for resultant force and resultant moment	113
Appendix C. Regularity of Eqs. (200)	113
References	115
Chapter 3. Thermal Stress Analysis Based on Maysel's Formula	
by <i>Franz Ziegler and Hans Irschik</i>	119
1. Introduction	120
2. General theory.	121
3. Maysel's formula and distributed dummy loads	135
4. Structural applications of Maysel's formula	143
5. Bending of thin plates	155
6. Thermoelastic deformation of thin shells	172
Appendix A. Maysel's formula generalized for anisotropic bodies	180
Appendix B. Thermal stresses in linearly viscoelastic bodies: Maysel's formula and the elastic viscoelastic correspondence	183
Appendix C. Application of Maysel's formula to nonlinear materials.	185
References	186

Chapter 4. Probabilistic Methods in Thermal Stress Analysis	
by Robert A. Heller and Surot Thangjitham	189
1. Introduction	190
2. Probabilistic and statistical preliminaries	192
3. Random processes	208
4. Stress and strength	216
5. Temperature models	218
6. Random temperature input to a semi-infinite slab	225
7. A simple stress-strength interference problem	229
8. Random thermal stresses in a layered cylinder	233
9. Calculation of the probability of failure	244
10. Reliability of brittle materials	249
11. Reliability of a proof-loaded, layered, hollow cylinder	256
12. Analysis of orthotropic materials	264
References	265
Chapter 5. Micropolar Thermoelasticity	
by Ranjit S. Dhaliwal and Avtar Singh	269
Preface	270
1. Introduction	271
2. Basic theorems	280
3. Displacement and other functions	284
4. Generalized micropolar thermoelasticity	288
5. Solutions of specific problems	296
6. Media with microstructure and micromorphic media	308
7. General remarks and some more references	316
References	319
Chapter 6. Low-Cycle Thermal Fatigue	
by Gary R. Halford	329
1. Introduction	330
2. Historical perspective	332
3. Thermal and thermomechanical fatigue – unbalanced deformation and cracking processes	336
4. Thermal fatigue resistance	361
5. Thermomechanical fatigue (TMF)	368
6. Bithermal fatigue	378
7. Isothermal life prediction models	385
8. Prediction of TMF lives using idealized isothermal characteristics	388
9. Thermal fatigue life predictions of engineering structural components	409
10. Do's and don'ts in design against thermal fatigue	416
References	420
Author Index	429
Subject Index	437