

Contents

Introduction	1
1 Application of thermoplastic and thermosetting polymers	1
1.1 Self-reinforced thermoplastic polymers	2
1.2 Fibre-reinforced polymers	2
2 Preliminaries on polymers	2
2.1 Structural principles	3
2.2 Distinction of polymers	4
2.3 Ranges of state	5
2.4 Application of polymers based on a phenomenologically motivated mechanical response	7
2.5 Mechanical behavior of thermoplastics	9
2.6 Thermo-chemo-mechanical behavior of thermosets	11
3 Overview on constitutive material modeling	13
3.1 General framework for the development of constitutive models	14
3.2 Parameter identification	17
3.3 Identification methods	17
3.4 Stability of least-squares problems	19
3.5 Uniform problems	20
4 Concluding remarks	21
Papers	23
Paper A: Experimental investigation of PC-films using optical measurements	25
Paper B: Simulation of strain-induced anisotropy for polymers with weighting functions	43
Paper C: Simulation of a Resin Transfer Molding Process using a Phase Field Approach within the Theory of Porous Media	69
Paper D: A three-scale framework for fibre-reinforced-polymer curing Part I: Microscopic modeling and mesoscopic effective properties	95
Paper E: A three-scale framework for fibre-reinforced-polymer curing Part II: Mesoscopic modeling and macroscopic effective properties	121
Paper F: (n)-and (n+1)-layered composite sphere models for thermo-chemo-mechanical effective properties	155
Paper G: On the design, characterization and simulation of hybrid metal-composite interfaces	185
Conclusion	203
1 Summary	203
2 Outlook	205
Bibliography	208