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3.3 The Stress-Strain Relationships 3.4 The Use of a Strain Energy Function; 3.4.1 Thermodynamic Considerations; 3.4.2 The Form of the Strain Energy Function; 3.4.3 The Strain Invariants; 3.4.4 Application of the Invariant Approach; 3.4.5 Application of the Principal Stretch Approach; References; 4 Rubber-Like Elasticity; 4.1 General Features of Rubber-Like Behaviour; 4.2 The Thermodynamics of Deformation; 4.2.1 The Thermoelastic Inversion Effect; 4.3 The Statistical Theory; 4.3.1 Simplifying Assumptions; 4.3.2 Average Length of a Molecule between Cross-Links 4.3.3 The Entropy of a Single Chain 4.3.4 The Elasticity of a Molecular Network; 4.4 Modifications of Simple Molecular Theory; 4.4.1 The Phantom Network Model; 4.4.2 The Constrained Junction Model; 4.4.3 The Slip Link Model; 4.4.4 The Inverse Langevin Approximation; 4.4.5 The Conformational Exhaustion Model; 4.4.6 The Effect of Strain-Induced Crystallisation; 4.5 The Internal Energy Contribution to Rubber Elasticity; 4.6 Conclusions; References; Further Reading; 5 Linear Viscoelastic Behaviour; 5.1 Viscoelasticity as a Phenomenon; 5.1.1 Linear Viscoelastic Behaviour; 5.1.2 Creep 5.1.3 Stress Relaxation 5.2 Mathematical Representation of Linear Viscoelasticity; 5.2.1 The Boltzmann Superposition Principle; 5.2.2 The Stress Relaxation Modulus; 5.2.3 The Formal Relationship between Creep and Stress Relaxation; 5.2.4 Mechanical Models, Relaxation and Retardation Time Spectra; 5.2.5 The Kelvin or Voigt Model; 5.2.6 The Maxwell Model; 5.2.7 The Standard Linear Solid; 5.2.8 Relaxation Time Spectra and Retardation Time Spectra; 5.3 Dynamical Mechanical Measurements: The Complex Modulus and Complex Compliance 5.3.1 Experimental Patterns for G₁, G₂ and so on as a Function of Frequency

Sommario/riassunto

"A substantially updated version of the previous 1983, combined with material from the highly regarded 2004 edition with the detailed mechanics of the first edition. Providing an updated and comprehensive account of the properties of solid polymers, the book covers all aspects of mechanical behaviour. This includes finite elastic behavior, linear viscoelasticity and mechanical relaxations, mechanical anisotropy, non-linear viscoelasticity, yield behavior and fracture. New to this edition is coverage of polymer nanocomposites, and molecular interpretations of yield, e.g. Bowden, Young, and Argon. The book begins by focusing on the structure of polymers, including their chemical composition and physical structure. It goes on to discuss the mechanical properties and behaviour of polymers, the statistical molecular theories of the rubber-like state and describes aspects of linear viscoelastic behaviour, its measurement, and experimental studies. Later chapters cover composites and experimental behaviour, relaxation transitions, stress and yielding. The book concludes with a discussion of breaking phenomena"--