Contents

1. Introduction

- 1.1 The Notion of a Continuum
- 1.2 Deformation and Strain
- 1.3 The Stress-field
- 1.4 Constitutive Relations
 - 1.4.1 Solids
 - 1.4.2 Fluids

2. Arbitrary Deformation

- 2.0.1 Deformation of an element of arc
- 2.0.2 Successive deformations
- 2.0.3 Deformation of an element of volume
- 2.0.1 Deformation of an element of area
- 2.0.5 Homogeneous deformation
- 2.1 Strain
 - 2.1.0 Stretch
 - 2.1.1 Change in included angle
 - 2.1.2 Principal fibres and principal stretches
 - 2.1.3 Decomposition Theorem
 - 2.1.4 Pure Rotation
 - 2.1.5 Tensor measures of strain
- 2.2 Plane deformation
 - 2.2.1 Shear
 - 2.2.2 Example of a shear process
- 2.3 Motion
- 2.4 The Continuity Equation

3. The Stress Field Concept

- 3.0.1 Traction
- 3.0.2 Tensor Character of Stress
- 3.1 Local equations of linear motion
 - 3.1.1 Symmetry of stress tensor
 - 3.1.2 Stress jumps (continuity conditions)
- 3.2 Principal Basis for Stress

3.2.1 Stress circle

- 3.3 Virtual Work Rate Principle
 - 3.3.1 Converse principle

4. Constitutive Relations

- 4.0.1 Simple materials
- 4.0.2 Material symmetry
- 4.0.3 Functional dependence
- 4.1 Energy balance
 - 4.1.1 Neglect of thermal effects
- 4.2 Elastic Materials
 - 4.2.1 Material symmetry
- 4.3 Isotropic Elastic Material
 - 4.3.1 Rotation
 - 4.3.2 Coaxiality of Cauchy stress and Eulerian triad
 - 4.3.3 Principal stresses
 - 4.3.4 Some isotropic work functions
- 4.4 Fluids

5. Linearised Elasticity

- 5.0.1 Linearisation of deformation
- 5.1 Constitutive Relation
 - 5.1.1 Isotropic response
 - 5.1.2 Interpretation of moduli
 - 5.1.3 Relations between moduli
 - 5.1.4 Example of linearisation
 - 5.1.5 Elastic constants
- 5.2 Uniqueness Theorem
- 5.3 Integral Theorems
 - 5.3.1 Reciprocal theorem
 - 5.3.2 Representation Theorem
- 5.4 Elastic Waves
 - 5.4.1 Isotropic media
 - 5.4.2 Green's tensor for isotropic media
 - 5.4.3 Interfaces

6. Some Fluid Flow Problems

- 6.1 The Navier-Stokes equation
 - 6.1.1 Heat flow
 - 6.1.2 Prandtl number
- 6.2 Rectilinear shear flow
- 6.3 Plane two-dimensional flow
 - 6.3.1 Glacial rebound
- 6.4 Thermal Convection
 - 6.4.1 Boussinesq approximation
 - 6.4.2 Onset of convection

7. Linear Viscoelasticity

- 7.1 Constitutive relations for linear viscoelasticity
 - 7.1.1 Creep and Relaxation
 - 7.1.2 Models of viscoelastic behaviour
 - 7.1.3 Isotropic linear viscoelasticity
- 7.2 Damping of harmonic oscillations

Problems