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Text
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Content
Continuum hypothesis, forces and stress fields, displacement and strain fields, governing field laws, applications to fluid, solid and magnetofluid mechanics, electrodynamics, electro- and thermoviscoelasticity

References
2. A. Cemal Eringen, Mechanics of Continua.

TOPICS

Continuum Theory
   The Continuum Concept
   Continuum Mechanics

Essential Mathematics
   Scalars, Vectors, and Cartesian Tensors
   Tensor Algebra in symbolic Notation
   Indicial Notation
   Matrices and Determinants
   Transformation of Cartesian Tensors
   Principal Values and Principal Directions of Symmetric Second-Order Tensors
   Tensor Fields, Tensor Calculus
   Integral Theorems of Gauss and Stokes

Stress Principles
   Body and Surface Forces; Mass Density
   Cauchy Stress Principle
   The Stress Tensor
   Force and Moment Equilibrium
   Stress Transformation Laws
Principal Stress; Principal Stress Directions
Maximum and Minimum Stress Values
Mohr’s Circle for Stress
Plane Stress
Deviator and Spherical Stress States
Octahedral Shear Stress

Kinematics of Deformation and Motion
- Particles, Configurations, Deformations, and Motion
- Material and Spatial Coordinates
- Lagrangian and Eulerian Descriptions
- The displacement Field
- The Material Derivative
- Deformation Gradients, Finite Strain Tensors
- Infinitesimal Deformation Theory
- Stretch Ratios
- Rotation Tensor, Stretch Tensors
- Velocity Gradient, Rate of Deformation, Vorticity
- Material Derivative of Line Element, Areas, Volumes

Fundamental Laws and Equations
- Balance Laws, Field Equations, Constitutive Equations
- Material Derivatives of Line, Surface, and Volume Integrals
- Conservation of Mass, Continuity Equation
- Linear Momentum Principle, Equations of Motion
- The Piola-Kirchoff Stress Tensors, Langrangian Equations of Motion
- Moment of Momentum (Angular Momentum) Principle
- Law of Conservation of Energy, the Energy Equation
- Constitutive Equations

Applications: Linear Elastic Solids
- Compatibility Equations for Infinitesimal Strain
- Elasticity, Hooks Law, Strain Energy
- Hooks Law for Isotropic Media, Elastic Constants
- Generalized Hook’s Law for Anisotropic Materials
- Elastic Symmetry, Hooks Law for Isotropic Media
- Isotropic Elastostatics and Elastodynamics, Superposition Principles
- Plan Elasticity
- Linear Thermoelasticity

Applications: Classical Fluids
- Viscous Stress Tensor, Stokesian and Newtonian Fluids
- Basic Equations of Viscous Flow, Navier-Stokes Equations
- Specialized Fluids
- Steady Flow, Irrotational Flow, Potential Flow
- The Bernoulli Equation, Kelvin’s Theorem

Applications: Nano mechanics
Applications: Viscoelasticity
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