

1. Record Nr.	UNINA9910460992403321
Autore	Allen Myron B. <1954->
Titolo	Continuum mechanics : the birthplace of mathematical models / / Myron B. Allen
Pubbl/distr/stampa	Hoboken, New Jersey : , : Wiley, , 2016 ©2016
ISBN	1-118-90934-8 1-118-90938-0
Descrizione fisica	1 online resource (293 p.)
Disciplina	531.076
Soggetti	Continuum mechanics Electronic books.
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Cover; Title Page; Copyright; Dedication; Preface; Contents; Chapter 1 Geometric Setting; 1.1 Vectors and Euclidean Point Space; 1.1.1 Vectors; 1.1.2 Euclidean Point Space; 1.1.3 Summary; 1.2 Tensors; 1.2.1 First-Order Tensors and Vectors; 1.2.2 Second-Order Tensors; 1.2.3 Cross Products, Triple Products, and Determinants; 1.2.4 Orthogonal Tensors; 1.2.5 Invariants of a Tensor; 1.2.6 Derivatives of Tensor-Valued Functions; 1.2.7 Summary; Chapter 2 Kinematics I: The Calculus of Motion; 2.1 Bodies, Motions, and Deformations; 2.1.1 Deformation; 2.1.2 Examples of Motions; 2.1.3 Summary 2.2 Derivatives of Motion 2.2.1 Time Derivatives; 2.2.2 Derivatives With Respect to Position; 2.2.3 The Deformation Gradient; 2.2.4 Summary; 2.3 Pathlines, Streamlines, and Streaklines; 2.3.1 Three Types of Arc; 2.3.2 An Example; 2.3.3 Summary; 2.4 Integrals Under Motion; 2.4.1 Arc, Surface, and Volume Integrals; 2.4.2 Reynolds Transport Theorem; 2.4.3 Summary; Chapter 3 Kinematics II: Strain and its Rates; 3.1 Strain; 3.1.1 Symmetric Tensors; 3.1.2 Polar Decomposition and the Deformation Gradient; 3.1.3 Examples; 3.1.4 Cauchy-Green and Strain Tensors; 3.1.5 Strain Invariants; 3.1.6 Summary 3.2 Infinitesimal Strain 3.2.1 The Infinitesimal Strain Tensor; 3.2.2 Summary; 3.3 Strain Rates; 3.3.1 Stretching and Spin Tensors; 3.3.2 Skew Tensors, Spin, and Vorticity; 3.3.3 Summary; 3.4 Vorticity and

Circulation; 3.4.1 Circulation; 3.4.2 Summary; 3.5 Observer Transformations; 3.5.1 Changes in Frame of Reference; 3.5.2 Summary; Chapter 4 Balance Laws; 4.1 Mass Balance; 4.1.1 Local Forms of Mass Balance; 4.1.2 Summary; 4.2 Momentum Balance; 4.2.1 Analysis of Stress; 4.2.2 Inertial Frames of Reference; 4.2.3 Momentum Balance in Referential Coordinates; 4.2.4 Summary
4.3 Angular Momentum Balance 4.3.1 Symmetry of the Stress Tensor; 4.3.2 Summary; 4.4 Energy Balance; 4.4.1 Thermal Energy Balance; 4.4.2 Summary; 4.5 Entropy Inequality; 4.5.1 Motivation; 4.5.2 Clausius-Duhem Inequality; 4.5.3 Summary; 4.6 Jump Conditions; 4.6.1 Singular Surfaces; 4.6.2 Localization; 4.6.3 Summary; Chapter 5 Constitutive Relations: Examples of Mathematical Models; 5.1 Heat Transfer; 5.1.1 Properties of the Heat Equation; 5.1.2 Summary; 5.2 Potential Theory; 5.2.1 Motivation; 5.2.2 Boundary Conditions; 5.2.3 Uniqueness of Solutions to the Poisson Equation
5.2.4 Maximum Principle 5.2.5 Mean Value Property; 5.2.6 Summary; 5.3 Fluid Mechanics; 5.3.1 Ideal Fluids; 5.3.2 An Ideal Fluid in a Rotating Frame of Reference; 5.3.3 Acoustics; 5.3.4 Incompressible Newtonian Fluids; 5.3.5 Stokes Flow; 5.3.6 Summary; 5.4 Solid Mechanics; 5.4.1 Static Displacements; 5.4.2 Elastic Waves; 5.4.3 Summary; Chapter 6 Constitutive Theory; 6.1 Conceptual Setting; 6.1.1 The Need to Close the System; 6.1.2 Summary; 6.2 Determinism and Equipresence; 6.2.1 Determinism; 6.2.2 Equipresence; 6.2.3 Summary; 6.3 Objectivity; 6.3.1 Reducing Functional Dependencies
6.3.2 Summary

Sommario/riassunto

Continuum mechanics is a standard course in many graduate programs in engineering and applied mathematics as it provides the foundations for the various differential equations and mathematical models that are encountered in fluid mechanics, solid mechanics, and heat transfer. This book successfully makes the topic more accessible to advanced undergraduate mathematics majors by aligning the mathematical notation and language with related courses in multivariable calculus, linear algebra, and differential equations; making connections with other areas of applied mathematics where parial
