

Engineering Continuum Mechanics



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This is a book designed for an introductory course in mathematical modeling in engineering. The content of the book will be mainly built on the three main principles of Mechanics: Conservation of Mass, Conservation of Linear and Angular Momentum, Conservation of Energy. Mainly one dimensional problems, which lead to the formulation and solution of elementary partial differential equations, w.r.t the spatial coordinate x and time t , will be treated. The principle of Mass conservation will be used for the formulation of the continuity equation for hydromechanics and specifically for Traffic Flow. The Conservation of Momentum Principle will be explained using examples from the reference volume method and from waves in inviscid fluids. An elementary discussion on the Navier - Stokes equation, with applications from the boundary layer theory, will be presented. Finally, the principle of Energy Conservation will be used for the formulation of the elementary theory of heat transfer in fluids and solids. As an application of the theory, a brief introduction is given to the continuum mechanics of fluid-infiltrated granular media, in the last section of the book. The book will be used for teaching Continuum Mechanics to undergraduate students of engineering faculties. The underlying theory will be presented in a simple way and mainly through the use of examples of natural phenomena. Special attention will be laid upon the use of the computer for the solution of physical problems. Numerous

worked examples will be included.

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