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In the creep-fatigue regime, a modeling analysis dealing with fatigue or creep loading conditions separately is not adequate for safety and reliability of design (Naumenko and Altenbach, 2007;...

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About this book. "Creep Modeling for Structural Analysis" develops methods to simulate and analyze the time-dependent changes of stress and strain states in engineering structures up to the critical stage of creep rupture. The principal subjects of creep mechanics are the formulation of constitutive equations for creep in structural materials under multi-axial stress states; the application of structural mechanics models of beams, plates, shells and three-dimensional solids and the ...

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The creep model derived by Harmathy is an important model since it is widely used for modeling creep in A36 structural steels. The Harmathy creep model considers both primary and secondary creep, and the creep rate in this model is expressed as follows: □ □ cr = f 1 (□) f 2 (T) f □ 3 (□ cr) where (4) f 1 (□) = 0.026 □ 4.7 1.23 × 10 16 exp (0.0003 □) □ □ 15000 psi 15 , 000 psi □ □ □ 45000 psi f 2 (T) = C exp - Q RT f □ 3 (□ cr) = coth 2 □ t □ t 0

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Creep processes may cause excessive deformations, damage, buckling, crack initiation and growth. Different types of creep failure in the recent years are discussed in the literature. Examples of critical structural members include pipe bends [186], welds [297], turbine blade root fixings [127], etc.

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184 Mathematical Modeling of Creep and Shrinkage form expression for n = 0.1, m = 0.), and Ao = 1 day has been found: Q(t, t') ~ Q{. 1 + (~)'] -l/r (2.105) with Z=t,-mln [1 +(t-t')"J (2.106) in which log Qf = - [0.1120 + 0.4308 log t' + 0.0019(log t')2J}

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This book develops methods to simulate and analyze the time-dependent changes of stress and strain states in engineering structures up to the critical stage of creep rupture. The objective of this book is to review some of the classical and recently proposed approaches to the modeling of creep for structural analysis applications. It also aims to extend the collection of available solutions of creep problems by new, more sophisticated examples.

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This second part of the work on creep modeling offers readers essential guidance on practical computational simulation and analysis. Drawing on constitutive equations for creep in structural materials under multi-axial stress states, it applies these equations, which are developed in detail in part 1 of the work, to a diverse range of examples.

This monograph presents approaches to characterize inelastic behavior of materials and structures at high temperature. Starting from experimental observations, it discusses basic features of inelastic phenomena including creep, plasticity, relaxation, low cycle and thermal fatigue. The authors formulate constitutive equations to describe the inelastic response for the given states of stress and microstructure. They introduce evolution equations to capture hardening, recovery, softening, ageing and damage processes. Principles of continuum mechanics and thermodynamics are presented to provide a framework for the modeling materials behavior with the aim of structural analysis of high-temperature engineering components.

This textbook gives a concise survey of constitutive and structural modeling for high temperature creep, damage, low □ cycle fatigue and other inelastic conditions. The book shows the creep and continuum damage mechanics as rapidly developing discipline which interlinks the material science foundations, the constitutive modeling and computer simulation application to analysis and design of simple engineering components. It is addressed to young researchers and scientists working in the field of mechanics of inelastic, time-dependent materials and structures, as well as to PhD students in computational mechanics, material sciences, mechanical and civil engineering.

Time dependent strain is an important factor in structural design, since it is often of the same order of magnitude as (or even larger than) instantaneous strain due to loading. Time dependent strain is generally due to creep and/or shrinkage. The time domain of creep and shrinkage can be of relatively long duration. Behavior of creep and shrinkage is actually non-linear over time, but the analysis of such behavior can be simplified by assuming linear behavior on a log scale of time. This can be obtained from a summation of each deformation over successive time intervals by superposition theory using a rate-type creep law, which provides suitable results for long time durations. The Maxwell Chain model, winch is one common form of rate-type creep law, is computationally efficient and suitable for large-scale analyses. Following background discussions, this thesis involves the implementation and basic validation of this type of rate-type creep formulation within lattice models for structural analysis.

One of the inherent modeling problems in structural engineering is creep of quasi-brittle materials (e.g., concrete and masonry). The creep strain represents the non-instantaneous strain that occurs with time when the stress is sustained. Several creep models with limited accuracy have been developed within the last few decades to predict creep of concrete and masonry structures. The stochastic nature of creep deformation and its reliance on a large number of uncontrolled parameters (e.g., relative humidity, age of loading, stress level) makes the process of prediction difficult, and yet accurate mathematical model almost impossible. This study investigates the potential use of Dynamic Neural Network (DNN) for predicting creep of structural masonry. The main motive of use DNN is that DNN could memorize the sequential or time-varying patterns while training process. Thus, DNN becomes more capable of capturing the time-dependent of creep deformation than the static networks. The results showed that the developed DNN models are able to predict the creep deformation with an excellent level of accuracy compared with that of conventional methods and the static networks models.

An extensive and comprehensive survey of one- and three-dimensional damage models for elastic and inelastic solids. The book not only provides a rich current source of knowledge, but also describes examples of practical applications, numerical procedures, and computer codes. The style throughout is systematic, clear, and concise, and supported by illustrative diagrams. The state of the art is given by some 200 references.

The use of new engineering materials in the aerospace and space industry is usually governed by the need for enhancing the bearing capacity of structural elements and systems, improving the performance of specific applications, reducing structural weight and improving its cost-effectiveness. Crystalline composites and nanomaterials are used to design lightweight structural elements because such materials provide stiffness, strength and low density/weight. This book reviews the effect of high temperature creep on structural system response, and provides new phenomenological creep models (deterministic and probabilistic approach) of composites and nanomaterials. Certain criteria have been used in selecting the creep functions in order to describe a wide range of different behavior of materials. The experimental testing and evaluation of time variant creep in composite and nanomaterials is quite complex, expensive and, at times, time consuming. Therefore, the analytical analysis of creep properties and behavior of structural elements made of composite and nanocomposite materials subjected to severe thermal loadings conditions is of great practical importance. Composite elements and heterogeneous materials, from which they are made, make essential changes to the classical scheme for constructing the phenomenological creep model of composite elements, because it reflects the specificity of the composite material and manifests itself in the choice of two basic functions of the creep constitutive equation, namely memory and instantaneous modulus of elasticity functions. As such, the concepts and analytical techniques presented here are important. But the principal objective of this book is to demonstrate how nonlinear viscoelastic engineering creep theory can be incorporated into the general theory of mechanics of materials so that composite components can be designed and analyzed. The results are supported by step-by-step practical structural design examples and will be useful for structural engineers, code developers as well as material science researchers and university faculty. The phenomenological creep models presented in this book provide a usable engineering approximation for many applications in composite engineering.