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Fracture Mechanics: Inverse Problems and Solutions

An inverse algorithm based on Proper Orthogonal Decomposition (POD) and Radial Basis Functions (RBF) for single and multiple cracks identification in plate structures is presented. The inverse analyses combine experimental fracture mechanics tests with numerical models based on the eXtended IsoGeometric Analysis (XIGA) method.

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This book presents, in a unified manner, a variety of topics in Continuum and Fracture Mechanics: energy methods, conservation laws, mathematical methods to solve two-dimensional and three-dimensional crack problems. Moreover, a series of new subjects is presented in a straightforward manner, accessible to under-graduate

students. Emphasizing physical or experimental backgrounds, then analysis and theoretical results, this monograph is intended for use by students and researchers in solid mechanics, mechanical engineering and applied mathematics.

Inverse Problems in the Mechanics of Materials concentrates on two timely subjects: Ill-posed inverse problems related to defect identification; and the mechanics of homogeneous and heterogeneous media, including such topics as cracked bodies, solids with interfaces or inclusions, and materials rendered inhomogeneous by irreversible deformation due to their thermomechanical history. These intriguing subjects are not found together in previous publications. Written in a unique, easy-to-read format, Inverse Problems in the Mechanics of Materials provides quick access to current information. It includes up-to-date references and many recent results, particularly in such classical subjects as elasticity, plasticity, and fracture mechanics. The reader discovers numerous recipes for solving inverse problems, and reviews of available methods provide applications to real-life problems in industry.

This title contains contributions by Japanese researchers on new approaches and results in fracture mechanics, that were previously unavailable in English. Applications of analytical methods such as body force method and boundary element method are included and a number of problems in crack mechanics are discussed.

This book focuses on mathematical theory and numerical simulation related to various aspects of continuum

mechanics, such as fracture mechanics, elasticity, plasticity, pattern dynamics, inverse problems, optimal shape design, material design, and disaster estimation related to earthquakes. Because these problems have become more important in engineering and industry, further development of mathematical study of them is required for future applications. Leading researchers with profound knowledge of mathematical analysis from the fields of applied mathematics, physics, seismology, engineering, and industry provide the contents of this book. They help readers to understand that mathematical theory can be applied not only to different types of industry, but also to a broad range of industrial problems including materials, processes, and products.

This book contains the proceedings of the IUTAM Symposium on Multiscale Modeling and Uncertainty Quantification of Materials and Structures that was held at Santorini, Greece, September 9 – 11, 2013. It consists of 20 chapters which are divided in five thematic topics: Damage and fracture, homogenization, inverse problems–identification, multiscale stochastic mechanics and stochastic dynamics. Over the last few years, the intense research activity at micro scale and nano scale reflected the need to account for disparate levels of uncertainty from various sources and across scales. As even over-refined deterministic approaches are not able to account for this issue, an efficient blending of stochastic and multiscale methodologies is required to provide a rational framework for the analysis and design of materials and structures. The purpose of this IUTAM Symposium was to promote achievements in uncertainty quantification combined with multiscale modeling and to encourage research and development in this growing field with the aim of improving the safety and reliability of engineered materials and structures. Special emphasis was placed on multiscale

material modeling and simulation as well as on the multiscale analysis and uncertainty quantification of fracture mechanics of heterogeneous media. The homogenization of two-phase random media was also thoroughly examined in several presentations. Various topics of multiscale stochastic mechanics, such as identification of material models, scale coupling, modeling of random microstructures, analysis of CNT-reinforced composites and stochastic finite elements, have been analyzed and discussed. A large number of papers were finally devoted to innovative methods in stochastic dynamics.

Residual Stress, Thermomechanics & Infrared Imaging and Inverse Problems, Volume 7 of the Proceedings of the 2020 SEM Annual Conference & Exposition on Experimental and Applied Mechanics, the seventh volume of seven from the Conference, brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on a wide range of areas, including: Test Design and Inverse Method Algorithms Inverse Problems: Virtual Fields Method Residual Stresses: Measurement, Uncertainty & Validation Residual Stresses: Eigenvalues, Modeling, & Crack Growth Material Characterizations Using Thermography Fatigue, Damage & Fracture Evaluation Using Infrared Thermography.

This title contains the edited proceedings from the 16th International Conference on Boundary Element Methods, held in July 1994. The included papers consider the applications of BEM to various mechanics problems and covers the topics of diffusion, acoustics, heat transfer, inverse problems, numerical and computational aspects, adaptive techniques, stress and fracture mechanics, elastodynamics, geomechanics and coupling problems.

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