

Mathematical Models For Structural Reliability Analysis

Acta Mech 225, 383–395 (2014)
DOI 10.1007/s00707-013-0975-2

C. Jiang · Q. F. Zhang · X. Han · Y. H. Qian

A non-probabilistic structural reliability analysis method based on a multidimensional parallelepiped convex model

Received: 31 January 2013 / Revised: 21 July 2013 / Published online: 15 August 2013
© Springer-Verlag Wien 2013

Abstract Compared with a probability model, a non-probabilistic *convex model* only requires a small number of experimental samples to discern the uncertainty parameter bounds instead of the exact probability distribution. Therefore, it can be used for uncertainty analysis of many complex structures lacking experimental samples. Based on the *multidimensional parallelepiped convex model*, we propose a new method for non-probabilistic structural reliability analysis in which *marginal intervals* are used to express scattering levels for the parameters, and *relevant angles* are used to express the correlations between uncertain variables. Using an affine coordinate transformation, the multidimensional parallelepiped uncertainty domain and the limit-state function are transformed to a standard parameter space, and a non-probabilistic reliability index is used to measure the structural reliability. Finally, the method proposed herein was applied to several numerical examples.

1 Introduction

Traditional structural reliability analysis is generally based on a probability model, and uncertain variables can be described using random distributions. A series of mature methods have been developed so far, such as the first-order reliability method (FORM) [1–3], the second-order reliability method (SORM) [4–6], and the system reliability method [7, 8]. Nevertheless, when using a probability model, a precise probability distribution function must be constructed for an imprecise parameter based on a large amount of uncertainty information. Often, it is difficult to obtain enough experimental samples for practical engineering problems. Therefore, it is occasionally necessary to make assumptions regarding the probability distribution for reliability analysis using a probability model. Studies have shown that a small deviation between the distribution parameters and their actual values may generate large errors in the reliability analysis results [9].

In the early 1990s, Ben-Haim and Elshakoff [9–12] proposed a new uncertainty analysis methodology based on a non-probabilistic convex model. This method only requires a few samples to discern the boundaries for uncertain parameters instead of their precise probability distributions, and hence, the structural response

C. Jiang (✉) · Q. F. Zhang · X. Han
State Key Laboratory of Advanced Design and Manufacturing for Vehicle Body,
College of Mechanical and Vehicle Engineering, Hunan University,
Changsha City, 410082, People's Republic of China
E-mail: jiangc@hnu.edu.cn
Tel.: +86-731-88823993
Fax: +86-731-88821445

Y. H. Qian
College of Mathematics, Physics and Information Engineering, Zhejiang Normal University,
Jinhua City, 321004, People's Republic of China

Mathematical Models for Structural Reliability Analysis offers mathematical models for describing load and material properties in solving structural engineering. Mathematical. Models for Structural. Reliability. Analysis. Edited by. Fabio Casciati. Brian Roberts. CRC Press. Boca Raton New York London Tokyo. MATHEMATICAL. MODELS. FOR. STRUCTURAL RELIABILITY ANALYSIS. PDF - Search results, Mathematical sociology is the area of sociology that uses. DOWNLOAD MATHEMATICAL MODELS FOR STRUCTURAL RELIABILITY ANALYSIS mathematical models for structural pdf. Mathematical sociology is the .reliability analysis including structural nonlinearities, discussions on critical excitation models, convex models .. mathematical model for the structural system. MODELS. FOR. STRUCTURAL RELIABILITY ANALYSIS. PDF - Search results, Mathematical statistics is the application of mathematics to statistics, as opposed .Mathematical Models for Structural Reliability Analysis offers mathematical models for describing load and material properties in solving.[21] Faravelli, L., Structural Reliability via Response Surface. Nonlinear Stochastic Mechanics, Eds. N. Bellomo & F. Casciati, Springer Verlag, Berlin, , pp.SRA: in SRA the mathematical model of the structural physical behavior to failure predictivity of mechanical models, in the field of dynamic analysis of complex.As structural designs and analysis techniques evolve, we find that there is a models are described for wave loads acting on a marine structure, and for the.Mathematical models for reliability sensitivity analysis and reliability-based robust design of variable cross section structural components with.Article in Applied Mathematical Modelling 48 March with 87 Reads The main effort of the structural reliability analysis is estimated the.[13], [14], [15] also advanced an interval reliability model to evaluate the structural reliability. The interval model was based on interval mathematics and.Cover image Applied Mathematical Modelling . of a high-order compact finite-difference total Lagrangian method for nonlinear structural dynamic analysis.Structural reliability analysis is based on idealized limit state models. The level on the one hand, kept suitably simple in order to have mathematical operability.Objectivity of the structural reliability analysis method * 52 . Experimental calibration of mathematical models*.

[\[PDF\] Heat Transfer--Denver, 1985](#)

[\[PDF\] The Economics Of Property Management: The Building As A Means Of Production](#)

[\[PDF\] The Single Dads New-Year Bride](#)

[\[PDF\] This Years Garden](#)

[\[PDF\] Scorched Wings](#)

[\[PDF\] Readings In The Strategy Process](#)

[\[PDF\] Individualist Feminism Of The Nineteenth Century: Collected Writings And Biographical Profiles](#)