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KOLLOQUIUM

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Thema: Structural Reliability in View of Non Linearity of Dynamical Systems

Zeit: Donnerstag, 22. Juni 2006, 16:00 Uhr c.t.

Ort: Baufakultät, Technikerstrasse 13, Hörsaal B619 (6. Stock)

Kurzfassung

The aim of structural reliability is to produce rational metrics of the safety of a system taking into account different sources of uncertainty, i.e. in loading or in structural parameters. A measure of reliability involves the estimation of the probability that a certain structural response exceeds a given threshold level (failure event). The most suitable way to determine the reliability of a structural system is using simulation techniques. The uncertainties in loading and structural parameters can be represented through random variables ($\{q\}$). Using appropriate transformation rules, the vector that groups these random variables ($\{q\}$) can be conveniently expressed in the normal standard space ($\{z\}$). Within all the possible realizations of $\{z\}$, several researchers have paid much attention to a particular vector which is known as the design point ($\{z\}^*$). This vector, which is a realization of $\{z\}$ which produces a failure event, is characterized by having the minimum Euclidean norm with respect to the origin of the normal standard space. The concept of the design point has been successfully used for studying the reliability of systems which behave linearly under a stochastic excitation and, eventually, with uncertain structural parameters. In these kind of structural systems, the information provided by the design point is conveniently used by approximate methods such as FORM (First Order Reliability Method) or SORM (Second Order Reliability Method) or by simulation methods like Importance Sampling to produce accurate estimations of failure probabilities with high efficiency if compared to more general methods, i.e. Monte Carlo Simulation. Several researchers have tried to extend the applications of the design point from structures which behave linearly to non linear problems. In the latter case, the task of finding the design point is quite challenging, since it involves the solution of an optimization problem which can involve large dimensions and, therefore, time – consuming computations. Closed – form solutions for determining the design point in non linear structures are available only for very particular cases and they lack of generality. Based on a series of observations that were made during the Benchmark Study on Reliability Estimation in Higher Dimensions of Structural Systems carried out by the IfM, this presentation discusses which role the design point is playing in estimating the reliability of structures which enter the non linear range under excitation. The discussion is carried out based on the observations generated through the resolution of simple examples of structural reliability problems rather than from a theoretical point of view. A critical appraisal of the use of the design point is made using these observations.

Über den Vortragenden

Marcos A. Valdebenito received his Diploma and Master's Degree in Civil Engineering from Federico Santa María University (UTFSM), Valparaíso, Chile, in January 2006. On march 2006, he joined the Doctoral Programme in Civil Engineering at the Leopold Franzens University (LFU), Innsbruck, Austria, EU. His current field of work is Reliability Based Optimization (RBO) at the Institute of Engineering Mechanics (IfM).

Gäste sind herzlich willkommen!