

Computational Stochastic Structural Analysis and Mechanics in Aerospace and Mechanical Engineering

The Institute of Engineering Mechanics at the Leopold-Franzens-University in Innsbruck, Austria, concentrates - over the last 20 years - its research efforts on the areas of Stochastic Structural Analysis and Mechanics and Structural Reliability including the respective Software Development. These methods allow a *rational* treatment of uncertainties involved in almost every analysis and design process and hence a quantified estimate of reliability, which, by traditional deterministic procedures is not feasible.

Openings for a number of Research Projects on a Doctoral and Post-Doctoral level are available:

Dynamic Response of Large Scale Structures under Environmental Loading Conditions

It is well known, that environmental loadings, such as wind, storms, earthquakes, etc. are - in deterministic terms - non-reproducible phenomena. Yet, these phenomena can be modeled realistically by stochastic processes and random fields, respectively, which require extensive numerical treatment. The structures themselves are to be modeled by Finite Elements. Response calculations of large-scale structures are most advantageously carried out by modal analysis. The project aims towards the development of computational procedures for predicting the response of both linear and non-linear larger scale structures under stochastic dynamic excitation. Methods of Monte Carlo Simulation as well as Equivalent Linearization – which in fact is also used in deterministic dynamics – will be applied.

Due to the required intensive computational efforts, parallel processing has to be also used. As in stochastic analysis significantly more information has to be processed when compared to its deterministic counterpart, the increase in computational efficiency is one of the major goals of the project. The result of this project forms then the basis of a subsequent assessment of the safety and reliability of this class of structures.

This project will be carried out in context with a Grant of the European Space Agency (ESA).

Reliability Based Optimization of Structures and Components

Structural Optimization is a well-established field, but generally concentrates mainly on weight minimization. However, in engineering practice the optimization of structures with regard to minimizing costs by maintaining a certain, i.e. target level of safety – or reliability respectively, is of primary interest. This project is mainly concerned with the development of a concept or Reliability Based Optimization (RBO) which also includes inspection procedures both at the beginning of the structural life as well as after particular lifetimes (periods) to assure the target reliability during the entire design life. Hence the optimization procedure also includes (computational) fracture and fatigue analysis in order to derive an appropriate quality assurance program, where maintenance and repair play an important role. The (dynamic) analysis of the structures under investigation is carried out by using FE models. Non linear optimization algorithms, such as NLPQL, will be applied. Computational efficiency of the developed procedures is one of the main issues of the project.

The project is carried out within the framework of University – Industry Interaction and is partially supported by industry active in Aerospace and Mechanical Engineering.

For a first information on the Institute please consult its home page

<http://mechanik.uibk.ac.at>

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