TECHNICAL INFORMATION

The software solution is written entirely in Fortran and is available as linkable library file. The code runs on the following platforms

- Windows
- Unix/Linux

The input file is organized in the human readable XML format. A GUI based application, that

- creates input files in a graphical way and supports the modeling of uncertain input parameters
- allows a graphical examination of the uncertain results
- and allows an additional robustness analysis

is available for the Windows platform. The fuzzy structural analysis warps around the (external) deterministic solution. Bindings to the deterministic solution must be realized with a user written subroutine. Thus, an application of this library requires basic skills in Fortran.

LICENSE

A free educational license for the *fuzzy analysis framework* is available to qualifying institutions. Software developed and results obtained using the *fuzzy analysis framework* may only be distributed or used on a non-profit making basis.

Please contact us for a commercial license.

REFERENCE

Möller, B., Beer, M.
Fuzzy Randomness - Uncertainty in Civil Engineering and Computational Mechanics,
Springer Berlin Heidelberg New York, 2004

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SOFTWARE SOLUTION FOR

FUZZY ANALYSIS

A FRAMEWORK FOR

FUZZY FINITE ELEMENT METHOD

NON-LINEAR DYNAMICS

SAFETY ASSESSMENT

MULTI BODY DYNAMICS

INVESTIGATIONS IN ROBUSTNESS AND SENSITIVITY

ARBITRARY NON-LINEAR ENGINEERING APPLICATIONS

WHY FUZZY ANALYSIS ?

A realistic and reliable numerical simulation in engineering demands adequate computational models with respect to data and model uncertainty. In many cases it is advantageous to describe uncertainty with the mathematical model fuzziness. The presented software enables the user to process such uncertainty with any computational model.

ANALYSIS CAPABILITIES

Fuzzy Analysis is a multi-purpose framework for predicting system responses with respect to uncertainty of input parameters in a numerically efficient way. It can be combined with any arbitrary analysis software as linear/non-linear deterministic solution. The uncertainty of the input parameters is reflected completely in the fuzzy result, which

- contains information about the variation of results
- allows worst case studies
- provides information about robustness and sensitivity with respect to the input uncertainty

FIELDS OF APPLICATIONS

- fuzzy finite element method
- non-linear dynamics
- safety assessment
- multi body dynamics
- investigations in robustness and sensitivity
- process simulation in engineering and science (e.g. life time analysis)
- crashworthiness
- economic investigations

ALGORITHM

The software solution *Fuzzy Analysis* enables the mapping of fuzzy input parameters onto fuzzy result parameters. As a mapping model, any arbitrary analysis program, e.g. FE-Programs, programs for dynamic analysis or safety assessment can be applied.

Fuzzy Analysis is performed with the aid of new numerical algorithms for uncertainty processing. The core procedure is called α-level optimization and operates according to a modified evolution strategy and is particularly suitable for non-linear problems.

For the fuzzy input parameters a sufficient high number of α-levels are chosen, and the fuzzy results are obtained α-level by α-level via fuzzy analysis.

USAGE

- combination of the fuzzy analysis with an arbitrary deterministic solution
- determination and quantification of uncertain input parameters
- performance of the fuzzy analysis
- result assessment

EXAMPLE

DAMAGE INVESTIGATION

The damage process of a 402 m long road bridge is investigated. Material parameters such as the compressive strength of the concrete and the strength of the reinforcement are modeled as fuzzy values. The structure and cross section is shown in Fig.1.

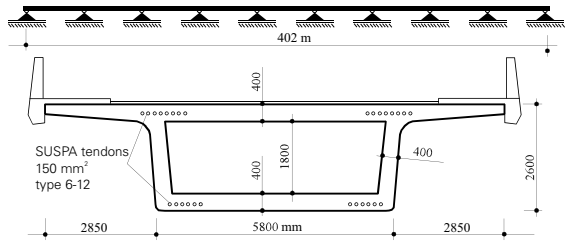

Fig. 1 structure and cross section

The development of the eigen angular frequency under an increasing load is determined. The result is a fuzzy process (Fig. 2) that reflects the uncertainty of the input values.

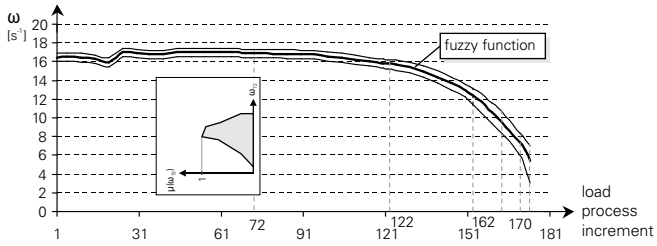

Fig. 2 development of the fuzzy eigen angular frequency

APPLICATION SCHEME