

PROBABILISTIC ASSESSMENT OF STRUCTURAL INTEGRITY

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Abstract

A probability-based approach is presented as the integration of probabilistic methods and deterministic modelling based on the finite element method. An existing finite element software package was linked to an existing probabilistic package to analyze the complex mechanics and to perform the transient nonlinear analysis of impact problems.

The finite element method is used for deterministic strength analysis of the structures. The deterministic finite element software NEPTUNE was used here for structural integrity analysis. This software can analyze the transient structural response of the structures, which undergoes large displacements and nonlinear material response in case of transient loading.

The ProFES software was used for the probabilistic analysis of structural failure. ProFES is a probabilistic analysis system that allows performing probabilistic finite element analysis in a 3D environment that is similar to modern deterministic finite element analysis.

The application of this methodology to Ignalina Nuclear power plants postulated accident is presented as example. The subject of the investigation are the collision between two adjacent GDH pipelines. The uncertainties of material properties, component geometry data and loads were taken into consideration. The probabilities of failure of the impacted header and of the header support-wall from uncertainties in material properties, geometry parameters and loading were estimated.

KEY WORDS: finite element method, probabilistic methods, deterministic-probabilistic structural integrity analysis, pipe whip impact