

A RSM Method for Nonlinear Probabilistic Analysis of the NPP Reinforced Concrete Structures

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Abstract

This paper describes the reliability analysis of a concrete containment for VVER 440 under a high internal overpressure. There is showed summary of calculation models and calculation methods for the probability analysis of the structural integrity considering degradation effects and high internal overpressure. The probabilistic safety assessment (PSA) level 3 aims at an assessment of the probability of the concrete structure failure under the excessive overpressure.

The non-linear analysis of the concrete structures was considered. The constitutive model presented is a further extension of the smeared crack model. Following the experimental results of Vecchio, Collins and Červenka and Kupfer a new concrete cracking layered finite shell element was developed and implemented into the ANSYS system. In this model the Kupfer's bidimensional failure criterion of concrete is considered.

The uncertainties of the loads level (long-time temperature and dead loads), the material model (concrete cracking and crushing, behavior of the reinforcement and liner), degradation effects and other influences following from the inaccuracy of the calculated model and numerical methods were taken into account in the response surface method (RSM). The results of the reliability analysis of the NPP structures are presented.

References

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