A BAYESIAN BASED RELIABILITY UPDATING APPROACH WITH THE APPLICATION OF SUPPORT VECTOR MACHINE

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Structural reliability and safety play a major role in all facets of human lives. Over the past few decades significant advancements have been made in incorporating and consideration of reliability and uncertainty analysis in a wide range of engineering disciplines and practices, including but not limited to aerospace, power generating plants, civil infrastructure systems, and manufacturing. However, due to lack of a complete understanding and predicting the structural response under various environmental impacts, changes and variations occurring in a structure through its life time, and/or modifications and redesign of a structure's components during its service life, the inherent uncertainties also change continuously. Therefore, the ability to update the reliability information is highly desirable. As a statistical analysis tool, Bayesian analysis has proved to be an efficient way to incorporate the probabilistic distributions with subjective information. By treating probability parameters as random quantities, a Bayesian based approach continuously optimizes the posterior probably density function based on the old information and the new measurements. In this paper, a Bayesian based approach combined with Support Vector Machine (SVM) is introduced to obtain the updated information of the system reliability. It is demonstrated that this approach leads to a more accurate and efficient updating algorithm for reliability analysis. A generalized reliability analysis model is used to verify the approach and the result is compared with the traditional first order reliability method.

Keywords: Bayesian approach, reliability analysis, support vector machine