

A Linear Response Surface based on SVM for Structural Reliability Analysis

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The Structural Reliability theory allows the rational treatment of the uncertainties and gives the methods for the evaluation of the safety of structures in presence of uncertain parameters. The main challenge is the computational cost, since the failure probability with respect to an assigned limit state is given as the solution of a very complicated multidimensional integral. The most robust procedure is the Monte Carlo Simulation (MCS), but especially in its crude form is very demanding. For this reason, wide popularity has been gained by the First Order Reliability Method (FORM) by its simplicity and computational efficiency. However, for strongly nonlinear systems the FORM approximation is not very close to the exact one. To this aim, in this paper we introduce a novel Linear approximation of the limit state, based on the Support Vector Method (SVM), and which allows to improve the FORM solution, starting from the knowledge of the design point.

Key Words: Structural Reliability Analysis, FORM, design point, Response Surface, Support Vector Method, Monte Carlo Simulation.