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A METHOD FOR RELIABILITY-BASED DESIGN MIXING SUPPORT VECTOR MACHINES AND PARTICLE SWARM OPTIMIZATION

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ABSTRACT

Reliability-based optimization has been considered as the ultimate goal of structural design, as it is purported to offer economical as well as safe models incorporating precise measures for both the minimal cost and allowable failure probability. The complexity of this task, however, has been recognized for long. In fact, both the optimization and reliability computations require large computational efforts.

In this contribution, a method for accurate and economical reliability-based optimization is proposed. It is based on the combination of the following techniques: Support Vector Machines [1], a computational learning method that been successfully used for reliability computations with a low number of samples due to the probabilistic properties of the ancillary margin functions for classification [2,3,4,5]; and Particle Swarm Optimization, which is a random search method with biological inspiration showing computational advantages over classical genetic or evolutionary algorithms [6]. The capabilities of the proposed methodology is demonstrated with benchmark test functions and real-life structural models.

REFERENCES

[1] V.N. Vapnik. *Statistical Learning Theory*, John Wiley and Sons, 1998.

[2] J.E. Hurtado and D.A. Alvarez. “A classification approach for reliability analysis with stochastic finite element modeling”. *J. Str. Eng.*, Vol. **29**, 1141–1149, 2003.

[3] J.E. Hurtado. “An examination of methods for approximating implicit limit state functions from the viewpoint of Statistical Learning Theory”. *Str. Saf.*, Vol. **29**, 2–15, 2007.

[4] J.E. Hurtado. *Structural Reliability. Statistical Learning Perspectives*, Springer, 2004.

[5] J.E. Hurtado. “Filtered importance sampling with support vector margin: a powerful method for structural reliability analysis”. *Str. Saf.*, Vol. **29**, 2–15, 2007.

[6] J. Kennedy and R.C. Eberhart. *Swarm Intelligence*, Morgan Kaufmann, 2001.