ADVANCES IN EVOLUTIONARY STRUCTURAL OPTIMIZATION CONSIDERING UNCERTAINTIES

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In deterministic based structural optimization problems the aim is to minimize the weight or the cost of the structure taking into account certain behavioral constraints on stresses and displacements as imposed, in a deterministic manner, by the design codes. However, in real world engineering applications, the uncertainties are inherent and the scatter of structural parameters from their nominal ideal values is almost unavoidable. Such uncertainties play a dominant role in the case of Reliability Based Design Optimization (RBDO) [1] and Robust Design Optimization (RDO) [2, 3].

In an RBDO problem additional non deterministic constraint functions are considered and the focus is on the minimization of the probability of failure of the structure, in order to meet specific design demands during its life-time. In RDO the aim is to minimize the sensitivity of the structural performance against the variability of the uncertain parameters related to structural capacity and load demands, yielding a design with a state of robustness.

The first part of the present work examines the application of Neural Networks (NN) to the RBDO of large scale structural systems [4]. In the second part, an RDO structural problem is considered. The optimization algorithm employed is a two stage multi-membered Evolution Strategies (ES) scheme. The stochastic finite element problem is solved using MCS, combined with the Latin Hypercube Sampling (LHS) technique in order to reduce the total number of simulations required.

References

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