Reliability-Based Design Optimization Using Kriging Metamodels in Moving Local Windows

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In this study, an approximate reliability-based design optimization (RBDO) using kriging metamodels is proposed. The double-loop structure for reliability analysis and design optimization of existing RBDO algorithms requires a large amount of numerical expenses. Thus, it is difficult to apply existing RBDO algorithms to the detailed design stage of real industrial products which usually requires expensive analyses. In the proposed approximate RBDO algorithm, adaptive dimension decomposition (ADD) methodology is used. ADD helps generating kriging metamodels effectively with reduced sampling points of the 1st and 2nd order terms in high dimensional model representation (HDMR). The proposed algorithm assigns local windows which consist of approximation and design windows in which sampling for kriging metamodel and RBDO is performed according to the target reliability index and type of probabilistic distributions of random variables. The local windows can move and shrink according to the convergence condition at the current iteration. The excellence of the proposed algorithm is verified using mathematical and engineering problems.

Keywords: approximate RBDO, ADD, moving local windows, kriging metamodel