# Reliability-Based Design Optimization Using Adaptive Design Regions

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ABSTRACT

In this study, a new approximate reliability-based design optimization (RBDO) algorithm is proposed. Existing RBDO algorithms require a large amount of numerical expenses due to a double-loop structure of the design optimization and the reliability analysis. Because of the numerical expense of RBDO, it is hard to apply existing RBDO algorithms to a practical design problem involving a numerically expensive simulation such as nonlinear crash analysis or computational fluid dynamics analysis. The proposed approximate RBDO algorithm adopts a concept of the sequential approximate optimization which is well-known for its efficiency. The proposed algorithm needs no additional numerical expenses and gradient evaluations except for the generation of the metamodel. The proposed algorithm assigns a design region according to the target reliability index, and sets the size of an approximation region larger than the design region considering the size of sampling region for Monte Carlo sampling or Latin hypercube sampling. The proposed algorithm adaptively updates the location and size of the design and approximation regions considering the convergence history of the approximate RBDO. Several mathematical problems were used to verify the effectiveness and usefulness of the proposed algorithm.

Key words: approximate RBDO; adaptive design regions; sampling methods

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