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# Reliability-Based Design Optimization of BIW Considering Variable Uncertainty of Thickness

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## Abstract

Reliability-based design optimization (RBDO) is one of the optimization technique based on stochastic approach. Many studies of stochastic approach assume the uncertainty of the design variable to be constant [1, 2]. However, when the uncertainty depends on the values of design variable, this assumption results in inaccurate conclusions. Therefore, the uncertainty should be considered as a variable in RBDO. Body-In-White (BIW) has been developed with optimization techniques. However, in past decades, when the thickness of BIW was optimized, the uncertainty of the thickness such as the tolerance had been assumed to be a constant. However, in practice, the tolerance of thickness depends on nominal thickness. Hence, in this paper, we carry out RBDO of BIW with the variable uncertainty. General Motors Korea provides the tolerance guide which defines the relation between the nominal thickness and the tolerance. We adopt the information to define the variable uncertainty. Thus, the variable uncertainty can modify the uncertainty with respect to the design point, resulting in accurate reliability estimation. Since BIW consists of over hundred parts, we select significant design variables using analysis of variance for four types of performances such as global stiffness, mode frequency, free-free stiffness and drive point dynamic stiffness. Then, surrogate model is employed to estimate the relationship between design variables and performances. Finally, we perform the RBDO with the variable uncertainty using Akaike information criterion (AIC) [3] method which determines the fittest distribution of performance based on maximum log likelihood function of candidate distributions. Consequently, we achieve the optimum design of the BIW which reduces the weight while satisfying the target reliabilities of the performances.

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