**Reliability- and Confidence-based Analysis, and Optimization**

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In this presentation, reliability analysis and reliability-based design optimization (RBDO) will be briefly explained. In addition, newly developed RBDO methods, such as RBDO with varying standard deviation and variable screening method will be explained.

Then, confidence-based reliability analysis and RBDO will be shown. Accurate reliability assessment requires accurate output distribution. To obtain correct output distribution, a very large number of output physical test data is required, which is prohibitively expensive. In regarding this, simulation-based methods have been developed given: (1) accurate input distribution models obtained from large number of input test data; and (2) accurate simulation model that correctly represents physical phenomena. However, in real applications, only limited number of input test data is available. Thus, input distribution models are uncertain. In addition, simulation model could involve bias due to assumptions and idealizations. To resolve the bias, model validation with large number of physical test data is necessary; however, only limited number of physical output test data is given. As a result, a target output distribution to which simulation model is validated is uncertain; the corresponding reliability is also uncertain. In this presentation, a confidence-based reliability assessment that combines uncertainty due to insufficient input/output test data and biased simulation model is proposed. In the proposed method, a hierarchical Bayesian analysis is formulated to obtain uncertainty distribution of reliability. After that, confidence-based reliability is selected at user-specified target confidence level. Through numerical examples, it is demonstrated that the proposed method can estimate a reliability of product that satisfies user-specified target confidence level.