POSSIBILITY-BASED MULTIDISCIPLINARY DESIGN OPTIMIZATION IN THE FRAMEWORK OF SEQUENTIAL OPTIMIZATION AND RELIABILITY ASSESSMENT

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Abstract. *Reliability Based Multidisciplinary Design Optimization (RBMDO) has received increasing attention to reach high reliability and safety in complex and coupled systems. In early design stage of such systems, however, there are insufficient data to precisely construct the probability distributions required by the RBMDO and consequently RBMDO can not be carried out effectively. To deal with this case, the present work proposes Possibility Based Multidisciplinary Design Optimization (PBMDO) and a method of PBMDO within the framework of the Sequential Optimization and Reliability Assessment (PBMDO-SORA). The proposed method enables designers to solve MDO problems with insufficient information on the uncertainties associated with design inputs, and efficiently decreases the computational demand. The efficiency of the proposed method is illustrated with a mathematical example and an engineering design.*
Keywords: Sequential optimization and reliability assessment, Multidisciplinary design optimization, Possibility based multidisciplinary design optimization

1. **Introduction.** In the last two decades, the consideration of uncertainty has been a focus of engineering design for complex and coupled systems. Reliability Based Multidisciplinary Design Optimization (RBMDO) has received increasing attention because of requirements for high reliability and safety in complex and coupled systems [1-8]. In [8], a Sequential Optimization and Reliability Assessment (SORA) method for RBMDO was proposed. SORA is based on the idea of decoupling reliability analysis from design optimization [9]. By using the MPP obtained from the previous cycle, the constraint in deterministic optimization is modified to make sure the MPP of current cycle fall into the feasible region. After solving the deterministic optimization, a new design point is obtained and followed by reliability assessment to check up the feasibility of each probability constraint at the new design point. Generally, the whole process of solution will converge in a few cycles.

However, in the early design stage of complex and coupled systems, due to time, environment and human, etc, there are insufficient data to precisely construct probability distributions which are basics in RBMDO. When distributions of variables are constructed using the limited available data, the Reliability based Design Optimization (RBDO) may lead to an unsafe design [10]. Results will be even worse for design with multiple disciplines. Possibility based Design Optimization (PBDO) is powerful to deal with problems