

Multidisciplinary Design Optimization (MDO) with Uncertainty for the Aircraft Design

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The Multidisciplinary Design Optimization (MDO) method is a methodology applied in designing systems that interact between multiple disciplines. This method is developed from the structural design optimization to consider the subsystem interaction when a structure has an attachment to the subsystem. It applies in the aerospace field when the interdisciplinary coupling between structures is too strong to be neglected. After that, the other disciplines such as aerodynamics, performance, and propulsion are included in the MDO, and it has been growing to the entire aircraft as a system. Generally, optimization requires a number of iterations, and the MDO can reduce the time required to execute the design process. By using the MDO methods, a designer may quickly and efficiently compute alternative design points over a wide range of parameters.

The uncertainty-based design optimization methods such as Reliability-Based Design Optimization (RBDO) and Possibility Based Design Optimization (PBDO) were applied with MDO to consider the errors from analysis tools. The RBDO method is used when the information concerning uncertain parameters is sufficient to generate accurate input of statistical distribution functions. However, the probabilistic method cannot be used for reliability analysis when a sufficient amount of uncertain data cannot be obtained. The Possibility Based Design Optimization (PBDO) method is proposed to overcome this disadvantage of the RBDO method. The PBDO method uses a fuzzy membership function for uncertain parameter modelling and is useful when it has insufficient data for producing probability density functions. This seminar will present the MDO with RBDO and PBDO methods and their applications. Also, the research plan for the Advance Air Mobility (AAM) will followed.

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