

Multi-Criteria Decision Analysis/Making

Multi-Criteria Decision Analysis/Making (MCDA/MCDM) is a process that allows one to make decisions in the presence of multiple, potentially conflicting criteria. In aerospace systems design, conflicting disciplines and technologies are always involved in the design process. MCDA/MCDM techniques can be helpful to effectively deal with such situations and make wise design decisions.



Figure 1: Typical aircraft selection problems

Although MCDM as a discipline only has a relatively short history of about 40 years, over 70 MCDM techniques have been developed for facilitating the decision making process. Among these developed MCDM methods, different methods have different underlying assumptions, information requirements, analysis models, and decision rules that are designed for solving a certain class of decision making problems. This implies that it is critical to select the most appropriate method to solve the problem under consideration since the use of unsuitable method always leads to misleading design decisions. Consequently, bad design decisions will result in big loss to the society, such as property damage or personal injury. However, it can be seen that the selection of MCDM methods itself is a complicated MCDM problem.

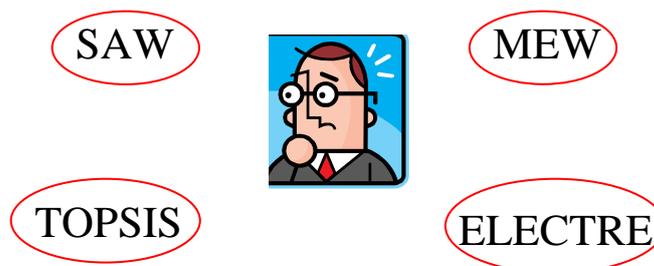


Figure 2: MCDM methods selection problem

In the MCDA process, the decision matrix and preference information are the main input data utilized to solve the decision problem. It is observed that there are always uncertainties existing in the decision matrix due to incomplete information or limited knowledge, while the weighting factors representing the preference information are often highly subjective, considering the fact that they are elicited based on decision maker's experience or intuition. The inherent uncertainties and subjectivities of the input parameters have significant impacts on the final result of a decision making problem. This implies that it is critical to effectively address these uncertainties in the decision making process in order to get more accurate results, thus, the uncertainty assessment associated with the decision matrix and weighting factors should be prudently performed.