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# MBSE and MDOA for Early Validation of Design Decisions: a Bibliography Survey

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## Content

The increasing complexity of aerospace systems has stimulated research work on models that enable early detection of design errors in the life cycle of these systems. A survey of the literature indicates two complementary approaches exist: MBSE and MDAO. The former -MBSE- consists in a top-down, model based approach to describe the entire system focusing on different points of view that cover at least structural and behavioral descriptions. This approach is mainly supported by informal to semi-formal languages that often do not directly offer automated reasoning capabilities. The latter -MDAO- is, on the opposite, fully dedicated to Analysis and Optimisation: the model is restricted to a single aspect of the system that is described in details in a formal language that will be the input of the associated computing tool.

So far, MBSE and MDAO have mostly been addressed separately since the two communities have few links in terms of goals and methods. However, a promising trend is to encourage collaborative engineering and research. The authors of this abstract contribute to bridge the gap between the two communities in the framework of FONISEN in a joint project between ISAE-SUPAERO and ONERA. Among the weaknesses of today's manual approach one may identify:

- 1) a lack of confidence in the fact that the MDAO model is a correct representation of the MBSE model part it is supposed to cover;
- 2) formal languages that support MDAO are often very verbose by nature and the models take some non negligible amount of time to be written and validated while part of the information is obviously already available in the MBSE description;
- 3) integration of the results of the MDAO process in the MBSE model is rarely made, either due to a lack of expressiveness of the MBSE language or due to the high time cost associated to the manual rewriting of the results with little gain expected from having this information available in the MBSE model.

In the project we will put in place some methodology to populate parts of the MDAO model directly from the MBSE one. This will have an impact on the three previous points: improving the confidence in the fact that the two models are addressing the same system, alleviating the effort to produce the MDAO model and hence helping expert to focus on parts of the MDAO model where human expertise is needed, and making explicit the links between the concepts of the MBSE model and the MDAO model opening the way to capture MDAO results in the MBSE model in a more systematic way. Generic modeling patterns - for which the transcription between the MBSE models and MDAO models is formally described - will be the privileged approach followed during this project.

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