

# System-Level Design Trade Studies by Multi Objective Decision Analysis (MODA) utilizing Modelica

Joshua Sutherland, Kazuya Oizumi, Kazuhiro Aoyama<sup>1</sup>  
Naoki Takahashi<sup>2</sup> Takao Eguchi<sup>3</sup>

<sup>1</sup>Department of System Innovation, The University of Tokyo, Japan,  
{joshua,oizumi,aoyama}@m.sys.t.u-tokyo.ac.jp

<sup>2</sup>Dassault Systèmes K.K., Tokyo, Japan naoki.takahashi@3ds.com

<sup>3</sup>Shinko Research Co. Ltd, Tokyo, Japan eguchi.takao@kobelco.com

This paper describes an approach and tool to conduct System-Level Design Trades Studies utilizing Modelica by way of Multi Objective Decision Analysis (MODA). Requirements for this being identified from the problems experienced on student Solar-Boat project.

The proposed approach and tool utilizes Modelica to predict performance of different competing alternative designs and MODA as a way to consistently compare those alternatives subject to a range of Assessment Scenarios.

To enable alternative designs to be created with low effort the replaceable feature of Modelica components is used such that the alternatives can share common architectures subject to a defined hierarchy (as shown in Figure 1) which includes the Assessment Scenario itself.

A tool was created to automate the placement of alternative designs into the Assessment Scenarios, run the simulations and consolidate the results via MODA (sample output provided in Figure 2).

Examples utilizing the approach and tool to predict performance of competing Solar-Boat designs and compare them is provided.

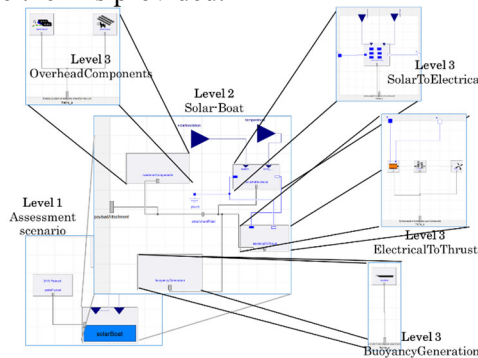


Figure 1. Hierarchy used in the Modelica models

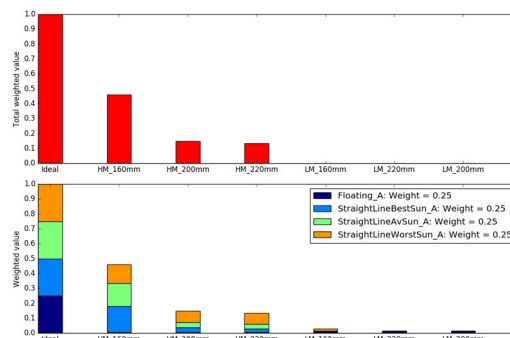


Figure 2. MODA results for six Solar-Boat alternatives and four Assessment Scenarios