1D-CAE による製品構成の探索

Design Exploration of Alternative Configurations Using 1D-CAE: A Value-Driven Design Approach Utilizing OPM and Modelica

ジョシュア サザーランド, 大泉 和也 , 青山 和浩

Joshua Sutherland, Kazuya Oizumi & Kazuhiro Aoyama

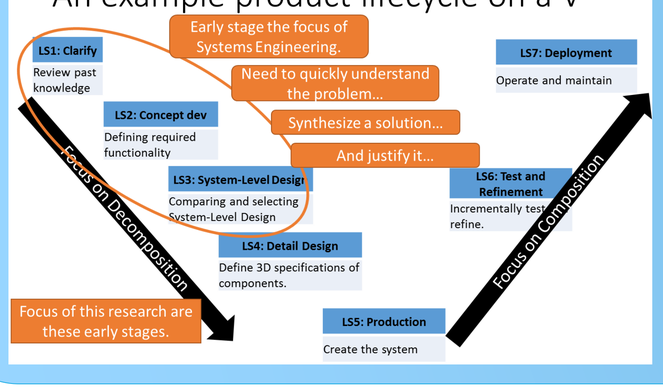
東京大学大学院工学系研究科 システム創成学専攻
Department of Systems Innovation, Graduate School of Engineering,
The University of Tokyo

1st Year PhD Candidate

東京大学
THE UNIVERSITY OF TOKYO

Problems to Address

An example product lifecycle on a V



Some specific problems from a student project

Lifecycle Stage:	LS1: Clarify	LS2: Concept dev	LS3: System-Level Design
Activities:	Review past knowledge	Defining required functions	Comparing and selecting System-Level Design
Identified problems from a student project:	Slow time to acquire initial knowledge	Unclear what the design target was	Little exploration of alternatives and their predicted outcomes
Proposed solutions:	Provide knowledge in models	Complete trade-off analysis of multiple designs using models to simulate performance	

Specific problems for this paper

- **Using Model Based Design (MBD) create tools and methodology to create and evaluate system designs:**
  - **Provide clarity of what the design target is and that the designs meet that target**
  - **Provide a consistent way to assess designs**
  - **Manage numerical model creation**

Current Solutions and Technologies

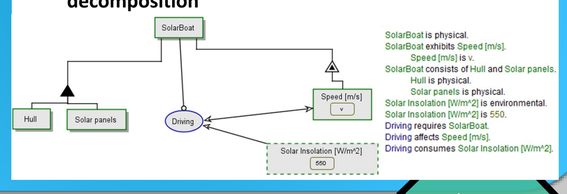
Descriptive Modelling Languages

SysML

Too much detail for early design stages

Object Process Methodology (OPM)

- ISO standardized conceptual modeling language
- **Single diagram type** accompanied with text models **behavior** and **structure**
- **Complexity managed** by **hierarchical decomposition**



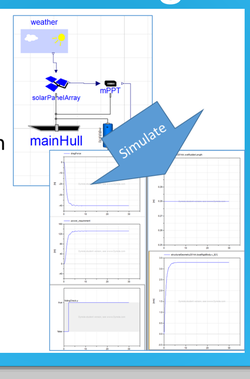
Value-Driven Design and Decision Theory

Utilize

Numerical Modelling Languages

Modelica

- **Multi domain numerical** simulation **modeling** system
- Supports **acausal component interactions**
- **Compose** using existing parts libraries or make your own
- Supports **hierarchy**

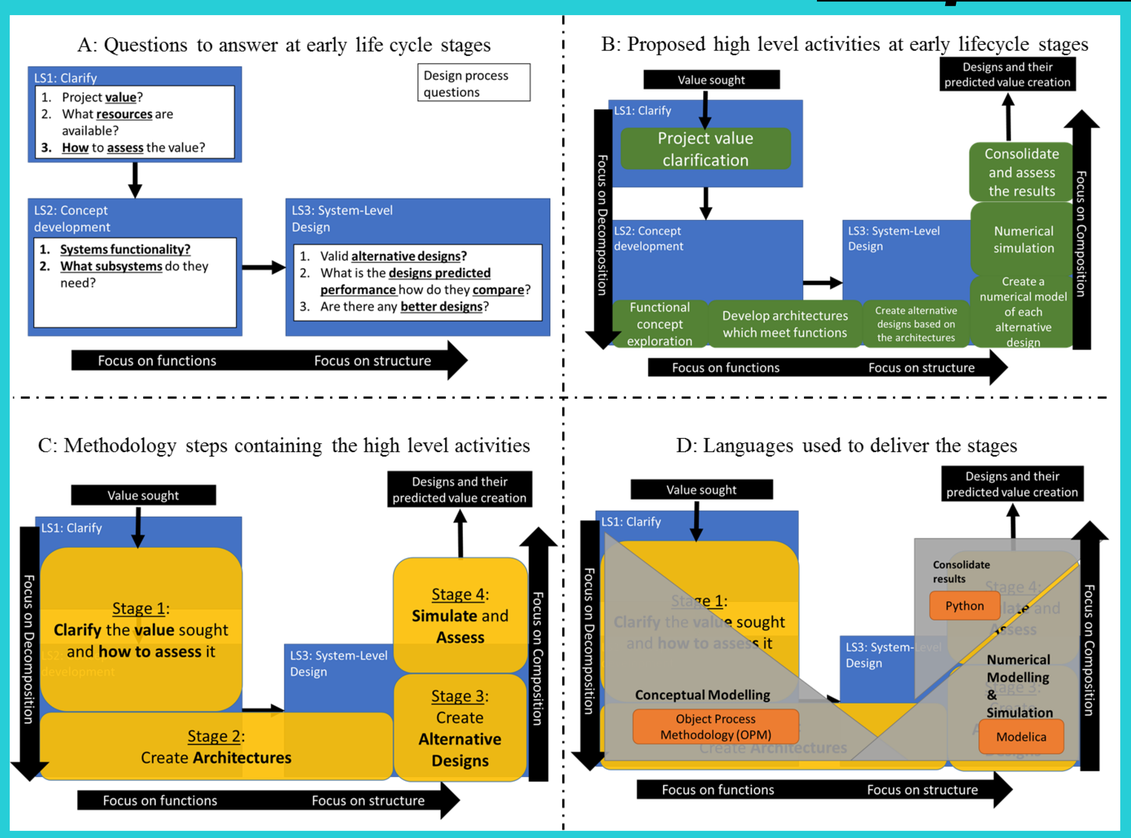


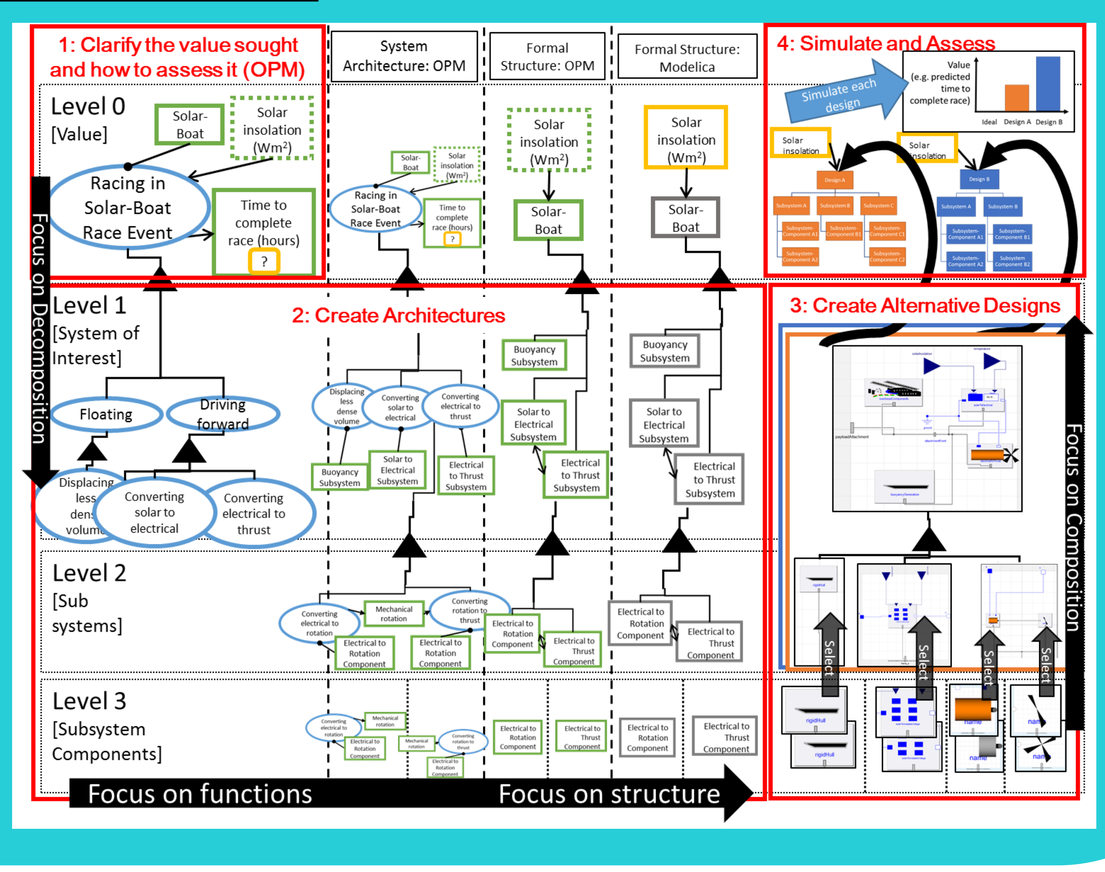
MATLAB/ Simulink

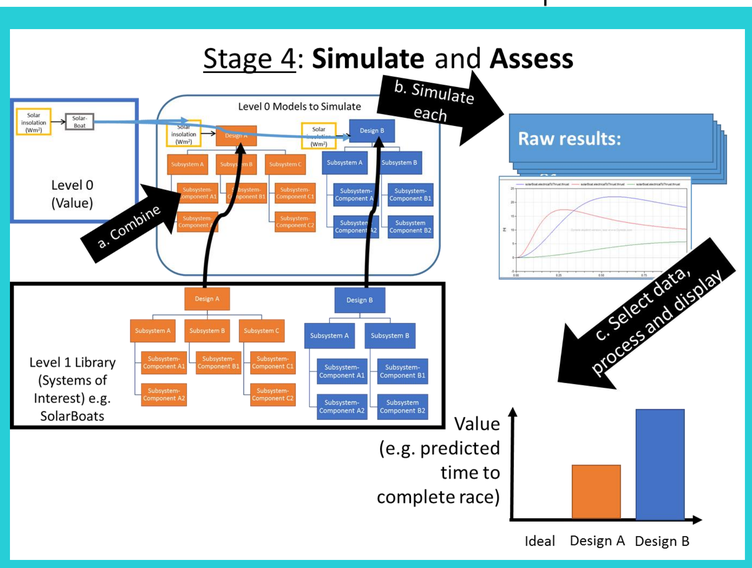
Requires much detail of the implementation

Utilize

Proposed Solution







Conclusion

- **Provide clarity of what the design target is and that the designs meet that target**
  - ➢**Design goals are described a product model in OPM**
- **Provide a consistent way to assess designs**
  - ➢**Describe how to evaluate the designs in OPM and use this to create a model in Modelica for assessment**
- **Manage numerical model creation**
  - ➢**By defining a mapping from OPM to Modelica with consistent hierarchy am able to create Modelica models logically**

Future work

Current issues	How to address
No uncertainty	Introduce Monte Carlo simulation
No guidance for decomposition	Utilize “Design Theory”
What is the benefit?	Show the number of designs identified
Too broad a topic area	Narrow to a single domain

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For more information or comments, please contact:

joshua@m.sys.t.u-tokyo.ac.jp

http://www.joshsutherland.com