



Early Design Synthesis with Formal Requirement Formulation for Complex Systems: A Computer-Base Systematic Approach

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ABSTRACT

This poster introduces an early design synthesis and its corollary, function-behaviour-structure, to early design analysis and engineering requirement formalism for complex systems. The aim is for a formal and systematic design approach with the intention of future coding as a computational tool to allow design automation.

BACKGROUND

Research Problem: Complex system design typically requires engineering teams (E_i) that are distributed in time (t) and space (s_p) and are often composed of many companies ($affl$), each with its own culture (C_{affl}), methods (m_d), and tools (tl). Effective design collaboration requires agreement and a thorough understanding of the various work assignments through a coherent design framework augmented with computer application.

$$E_t(csdes) = t \cdot s_p \cdot affl \cdot C_{affl} \cdot m_d \cdot tl$$

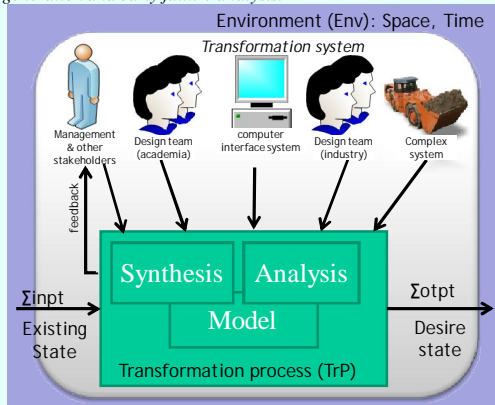
Where $\{E_t(csdes)\}$ is dubbed the "Six-factor formula" associated with the design team in a complex system design environment.

Research Question: Do requirements in engineering design spend the gap between the informal world of the customer and the formal world of system behavior? Is there a realization of smooth transition from needs to comprehensive initial modeling? Is there sufficient engagement of computer systems in conceptualization?

Hypothesis: A coherent early design model with formal requirement will improve the rigor of early design analysis and intensify computer use in systems engineering.

OBJECTIVE

To transform the existing state of informal concept design to a desire formal state using synthesis, analysis, and models with the integration of different stakeholders, target system and digital computer under the same design environment for efficient concept generation and early failure analysis.



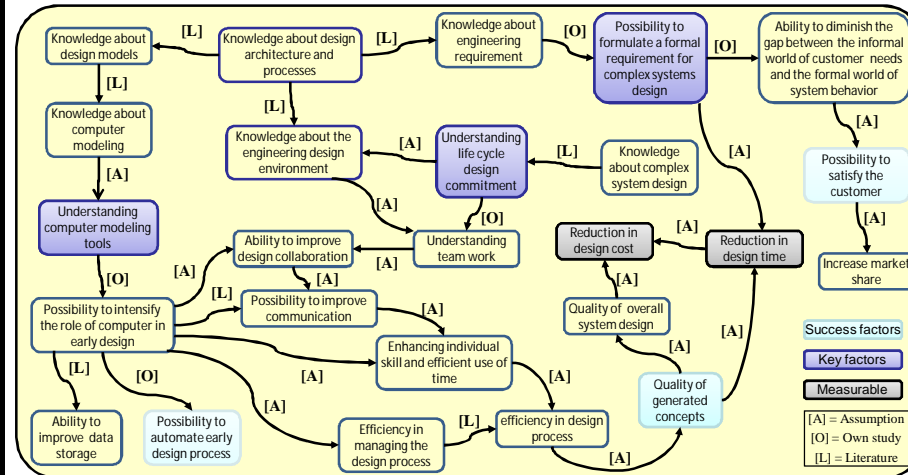
SPECIFIC CONTEXT

To develop a conceptual design model base on function-behavior-structure with a formal requirement model for computer application and early design automation.

DESCRIPTIVE STUDY I

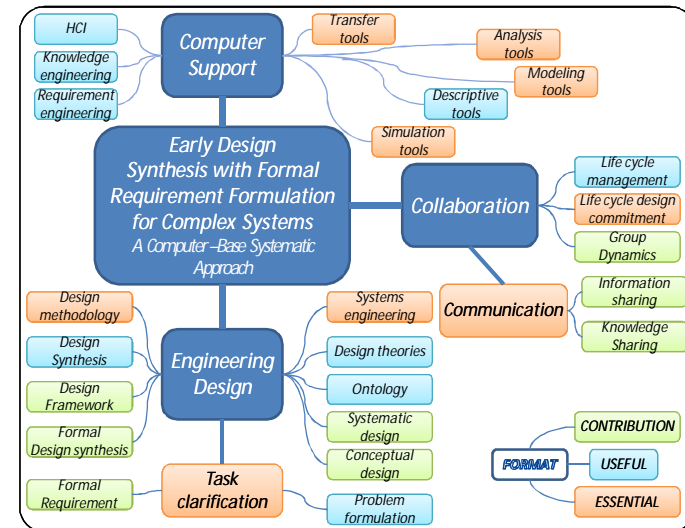
Participation in, and interaction with different stakeholders involve in the design of target complex system. Literature studies of existing design methodologies and requirement engineering.

REFERENCE MODEL



THEORETICAL FOUNDATION

Areas of Relevance and Contribution (ARC)-diagram

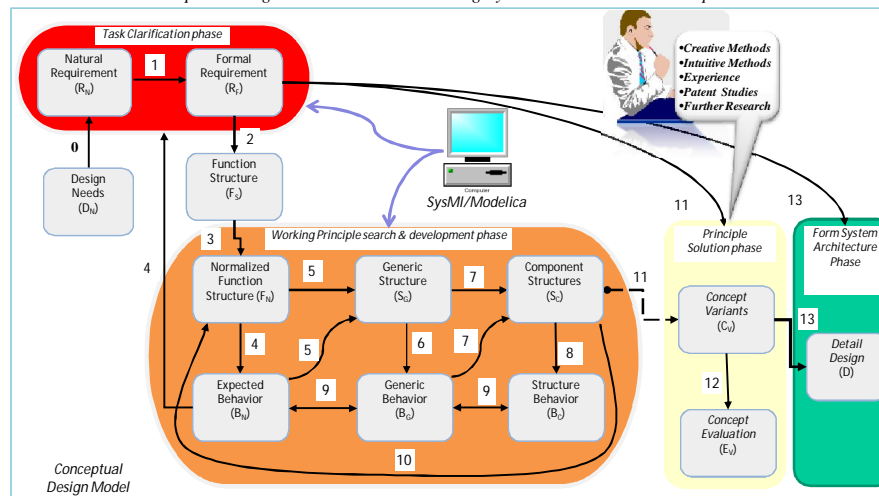


PRESCRIPTIVE STUDY

1. Creation of a conceptual design model for a systematic and formal design synthesis and analysis
2. Creation of a formal requirement model for engineering design
3. Integration of conceptual design model with SysML and Modelica

RESEARCH APPROACH

Methods: Conceptual Design Base on FBS-Model using SysML and Modelica as computer tools



DESCRIPTIVE STUDY II

Application of conceptual design model with target complex system

EXPECTED RESULTS

To integrate the developed model framework into SysML modeling language intensify computer use and to allow failure analysis early in the design phase. This study is also situated to spend the gap between the design community of the academia and industry

