Process and Systems Complexity
(Panel Introduction Statement)

Jerzy W. Rozenblit
Department of Electrical and Computer Engineering
The University of Arizona
Tucson, Arizona 85721-0104
U.S.A.
jr@ece.arizona.edu

Abstract

This statement introduces the ECBS Complexity panel. It provides a framework for a debate on the complexity of the ECBS process and its products. We attempt to address the questions of what constitutes complexity, how to measure it, and how to provide engineering techniques that can handle its effects.

1. ECBS Complexity

The purpose of this panel is to provide a forum that will address complexity in the engineering of computer-based systems. Well established, formal methods exist to analyze computational complexity expressed in time and space dimensions. Such methods are typically used by computer scientists and operations researchers who focus on the optimization of algorithms for solving computationally hard problems. Often, suboptimal solutions are sought by introducing various heuristics that trade-off optimality for time efficiency.

It can be shown that the general systems design and engineering problem, formulated as the process of translating the need and requirements into a product, belongs to the class of computationally hard problems [5]. Little work, however, has been done to address complexity of systems engineering in a broader context, i.e., one that would extend beyond algorithmic complexity. Therefore, through this panel, we intend to initiate a debate on:

a) How complexity of (engineering of) computer-based systems is defined?
b) What are its tangibles and intangibles?
c) What are the factors contributing to the complexity of ECBS?
d) How can the perils of complexity be alleviated?
e) How can we manage the complexity of ECBS?

Our working supposition is that it is necessary to consider the complexity of the underlying product that the engineering process results in as well as the complexity of the process itself. The process-product relation must be understood clearly by the designers and engineers who develop the system. The product and all its components such as hardware, software, interfaces, etc. exhibit varying levels of complexity. Similarly, the process steps used to develop the product, their ordering, scheduling, require an efficient analysis and control techniques. In order to understand this relation and the interplay of its elements, we argue that well structured knowledge representations and models are beneficial. They help organize and manage the multitude of facets in a complex system and facilitate virtual process and product prototyping. Such virtual, model-based prototypes can be the basis for assessing the solution by simulation prior to the system's deployment.

This panel addresses the complexity issues through a series of position statements that argue for a more systematic and holistic approach to ECBS. More specifically, Keepence et al. [1] examine the nature of complexity and its dimensions, point out the perils of ECBS which stem from the underlying process and systems complexity, and suggest a means reduce such perils.

Lawson [2] proposes a holistic approach that strives to unify the software and hardware aspects of computer-based systems. He advocates that hardware and software must be developed in ways that complement each other, rather than in isolation. Mulcare [4] gives a detailed view of systems design issues and discusses how it is necessary

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to ensure coherence in the process and products to mitigate the effects of complexity.

Mrva [3] extends the notion of design habitability from the software perspective into a broader, more encompassing systems view. He argues that establishing the "right" design culture and climate fosters collaborative, efficient and effective systems development.

Through this panel, we hope to initiate a discussion on ECBS complexity and to seek active feedback from the community of researchers and practitioners.

References

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