Chapter 84
New Design Paradigm: Shaping and Employment

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ABSTRACT

The multiple shortcomings of the current Design paradigm manifest the need of its modification. Our objective was to find out an appropriate mechanism. But such a mechanism could not be revealed without assistance of a Design theory. The emergent dilemma – to use one of the available theories or develop a new one – was resolved by choosing the third way: rearrangement of the material at hand on modularity principles with initiation of fundamental (systemic) Design theory module via identification of its paradigm. While doing this, we had to overcome a number of delusions ingrained in engineering design, concerned firstly with design problem, process and design representation. To push these efforts forward, a scientific base named Continuous Process Theory had been developed. Systemic module initiation enabled to define a paradigm of the second Design theory module – the sought-for Design practice paradigm. Discussion on the outcomes of this definition rounds off this chapter.

INTRODUCTION

The Way to Reveal an Adequate Design Paradigm

The title of the chapter declares generation of a new design paradigm – the set of practices that define and drive (implements and manage) design process (*DPR*). This assumes that a certain version of the paradigm is available. Indeed, it cannot be out of place because of many decades of everyday designing. Design paradigm ("applied theory") is crystallized by design practice and is needed for practitioners in each design field – whether it be mechanical engineering, information science, architecture, chemistry, nano-technology or something else. Design paradigm is the base of design methodology within a given domain and the benchmark for developers of computer-aided design facilities.

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In Design theory absence, Design paradigm formation was spontaneous: the values of its descriptors mirror a specialized empiricism, intuition, experience, borrowings, parts of theories possessed by other disciplines, etc. This has stipulated a number of weak points of the paradigm. With the reference to design in mechanical engineering, recall some of those:

- it employs semi-intuitive design language;
- supports mainly adaptation design;
- generates ill-observable, non-holistic *DPR*, which is equally insufficient for learning and teaching and for the most part implicit;
- has no ideas how to keep the *DPR* complexity to a manageable level;
- structure synthesis problem remains unsolved;
- the role of computer in designing is obscure and insufficient;

Thus, modification or replacement (radical modification) of design paradigm is anticipated and in demand. However, there is no a regular mechanism of paradigm improvement, which should concurrently be a mechanism of paradigm identification forgoing to its change. Let us try to find out such a mechanism.

To be analyzed, evaluated and modified, the paradigm should have a sort of representation. We associate with any Design paradigm representation a set of descriptors or *paradigmants* – the certain characteristics of a paradigm, which take on one or another value. Thus, paradigmants characterize via their values this or that paradigm during a certain period of time. For instance, Design paradigm is concerned with such paradigmants as *notion base of design language* (formalized ∨ intuitive ∨ semi-intuitive), *the mode of structure synthesis problem realization* (explicit ∨ implicit), *design system architecture* (an hierarchy of subsystems ∨ another) and others.

If paradigm representation is available, we define a paradigm modification as the change of values for one or a subset of its paradigmants. To regularize the way of paradigm change, we distinguish within its representation a minimal subset of paradigmants sufficient for a unique paradigm identification – call it *design paradigm signature* (*Sg*). Then change of values for paradigmants, which are beyond the signature, would signify the paradigm modification, while the change of value for at least one signature's paradigmant replaces the paradigm. A signature considered without its paradigmants values is called a signature platform or *meta-signature* (*mSg*). Choosing different variants of *mSg* attribution, the produced signature alternatives (paradigm identifiers) could be compared and paradigm assessed as a whole.

It should be noted that the outlined mechanism of paradigm identification and modification has a heuristic base – the choice of both paradigm representation and modification rests mainly on experience, intuition and experiment. This does not make the mechanism reliable. Besides, it generates only paradigm clones according to given representation – this deprives the mechanism of practical value. Generation of paradigm versions becomes possible after changing the course of identification for an opposite one. This means that paradigm representation initially is unavailable and its deriving begins with identification of Design paradigm meta-signature and signature. Then the paradigm representation will be obtained by deployment of its signature. But such a systematic way of Design paradigm handling needs for feeding it by a resource of paradigm *mSg* generation. Such a resource could be provided by a Design theory only.

TOWARDS DESIGN THEORY PARADIGM IDENTIFICATION

Requirements to Design Theory

Does the stated need for Design theory signify development its new version or sampling from the