

Conference Paper

Implementation of a Systematic Approach to the Design a Communal Car CM

S.V. Mitrofanov

Machine-Building Plant named after Kalinin, Russia, 620017, Ekaterinburg, avenue Kosmonavtov, 18

Abstract

The article presents an analysis of the implementation of a systematic approach to the design of CM at the enterprise of the military industrial complex without experience in the development of civilian products using requirements engineering. The advantages of architectural and modular principles in the design are described and how these principles are integrated into a single system of design documentation is shown.

Annotation: utility vehicle, modular principle, unified system of design documentation.

Corresponding Author:
 S.V. Mitrofanov
 sergeydonner@yandex.ru

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1. Introduction

Within the framework of import substitution state programs, localization and increasing the market share of domestic products at defense industry enterprises, as well as while studying the experience of developing domestic and foreign industries in modern conditions with frequent updating of the production facilities line, it has been shown that the introduction of standardization, unification and aggregation methods are decisive conditions for development of products with a percentage of novelty more than 50%. The characteristic features of modern design technology include a system approach methodology based on the general theory of technical systems, system dynamics, system analysis, operations research, reliability theory, economics, decision theory, information theory; end-user satisfaction strategy; high degree of formalization and typification of design procedures and operations; creation of a database and knowledge base.

These features allow you to [1]:

- significantly reduce the time and cost of designing and manufacturing CM;
- increase the constructive continuity of early development;
- significantly reduce the need to develop new special equipment, technological equipment;
- reduce the range of used parts and assembly units.

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In relations to the military-industrial complex enterprise, the production of standard and unified parts, assembly units and modules is allowed by the architectural representation of CM as a system consisting of a set of the simplest subsystems of the first level, which, in turn, comprise larger subsystems of the second level.

In turn, the architecture at the stage of pre-design studies allows us to evaluate the volume of technical tasks; the possibility of implementing the design requirements and specification of goals; the correctness of the adopted technical and artistic decisions.

1.1. Integration into a unified system of design documentation

The unified system of design documentation (GOST 2.101) establishes the following types of products: parts, assembly units, complexes, kits [2]. The systematic approach allows us to consider assembly units as subsystems that determine the corresponding level [3] (Fig. 1):

- frame - a subsystem of the first level;
- front frame - subsystem of the second level; - rear frame - subsystem of the second level;
- engine - a subsystem of the first level; - engine cooling system - a subsystem of the second level;
- electrical equipment - a subsystem of the first level; - hydraulic system - a subsystem of the first level; - hydraulic motors - subsystems of the second level;
- hydraulic pumps - subsystems of the second level; - wheel - a subsystem of the first level.

Each subsystem is a set of modules and elements, which are connected to each other. The modular principle allows simultaneous work on many assemblies, which reduces the time to develop the entire CM; reduce the range of spare parts, volumes of original documentation for product modifications (optional). In Fig. 1, two subsystems are distinguished between the front and rear half-frames, while the front half-frame with its modules and elements remains unchanged, the rear half-frame can change (weight and size characteristics) in depend of the requirements of the technical specifications.

A systematic approach determines the relationship between modules and elements, both external and internal. The presence of internal connections determine the system as integrity. Connections are classified according to the nature of the each interacting module's purpose [4]. In Fig. 1 CM, several types of internal relations are classified according to unified system of design documentation:

- component internal communications of subsystems and elements included in them (unified system of design documentation - primary applicability in nodes);

- aggregate internal connections between modules (unified system of design documentation - fasteners or welded elements inside subsystems);
- communication of the purpose of interaction between the modules (unified system of design documentation - kinematic, hydraulic and electrical circuits);
- control, command internal communications, including feedback between the modules (unified system of design documentation - CAN list - communication metrics for twisted pairs, electric current characteristic).

The architecture of the CM (Fig. 1) does not reflect the external relations of interaction with the environment [3].

During the development of subsystems and interfaces, the following steps were carried out at each of the levels:

- verification according to relevant criteria, for example, a frame, as an assembly unit was considered according to three criteria: mass, strength and complexity of manufacturing;
- correct accounting of the current state of competitive products;
- forecast of development for a period of time not less than the life cycle of CM;
- analysis of the contradictions that arise in the process of optimizing the CM design.

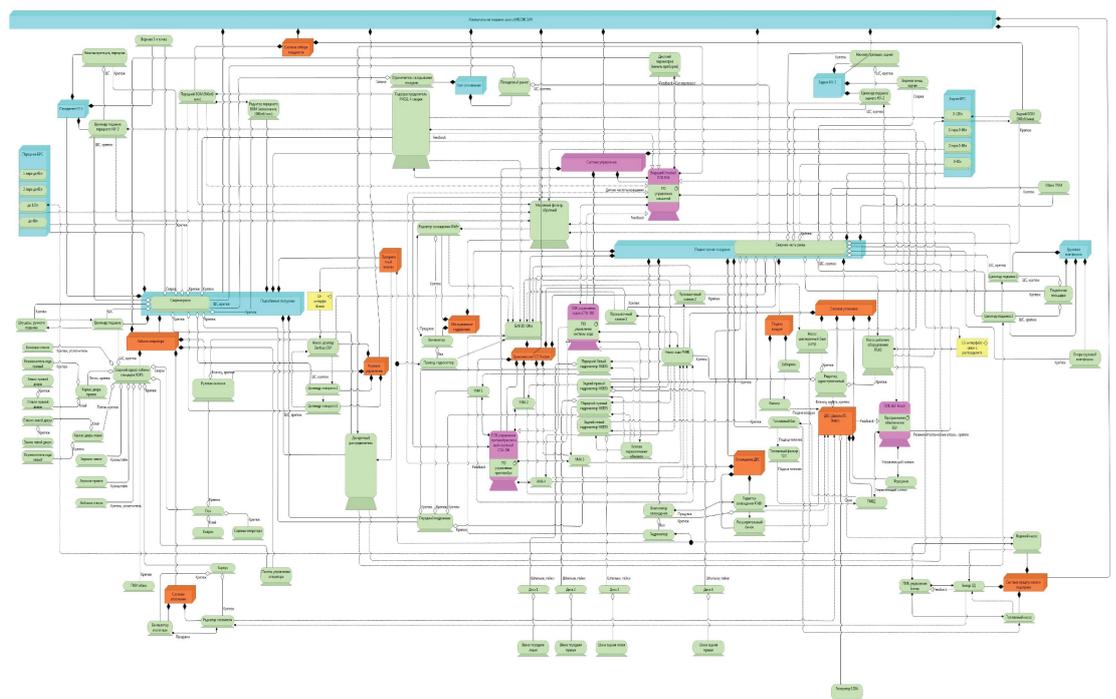


Figure 1: KM architecture

2. Conclusions

1. The design process at any stage consists of design procedures and operations and it is accompanied by design decisions.
2. Especially it is applied in the modern design technology used in CAD.
3. The proposed architectural method for representing CM allows you to create an understandable architecture of the system, to simplify the working design.

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