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ІННОВАЦІЇ В СУДНОБУДУВАННІ ТА ОКЕАНОТЕХНІЦІ
МАТЕРІАЛИ XII МІЖНАРОДНОЇ НАУКОВО-ТЕХНІЧНОЇ КОНФЕРЕНЦІЇ
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МИКОЛАЇВСЬКА ОБЛАСНА ДЕРЖАВНА АДМІНІСТРАЦІЯ
ДЕПАРТАМЕНТ ОСВІТИ І НАУКИ МИКОЛАЇВСЬКОЇ ОБЛАСНОЇ ДЕРЖАВНОЇ АДМІНІСТРАЦІЇ

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AUTOMATED WORKSTATION MODEL OF THE SHIP ELECTRIC POWER PLANT PARAMETERS MONITORING SYSTEM

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Abstract. An approach to the description of the graphical user interface of the ship electric power plant parameters monitoring system operator's automated workstation is considered. The developed model of the operator's automated workstation is a system of interconnected elements and relations between them, and can be used both for high-level design and description of the operator's interaction with the system, and for low-level design and description of the interaction of system elements at various levels of decomposition. A distinctive feature of the proposed model is the reflection in it the internal structure oof the graphical user interface elements and their behavior algorithms using the same mathematical description.

Keywords: conceptual model, automated workstation, control element, parameter monitoring

The ship electric power plant (SEPP) parameters monitoring system is presented in the form of a hardware-software complex [1, p. 12], which solves the problem of collecting, processing, displaying and storing data, making decisions on the control signals formation. During the developing the graphical user interface (GUI) of the SEPP parameters monitoring system, methods of conceptual modeling of information processes and intelligent systems were used. [2, p. 154; 3, p. 810].

The generalized conceptual model of the GUI is a set of processes and objects:

$$S_{ГI} = \langle P, D, G, H_p, H_d, H_g, S_p, S_d, S_g, InD, InG, OutD, OutG \rangle,$$

where $P = \{p_i\}$ – a set of the imaging and information processing procedures; $D = \{d_i\}$ – a set of information objects; $G = \{g_i\}$ – a set of graphical objects; H_p, H_d, H_g – establish a correspondence between individual objects of the model and a set of subordinate subobjects; S_p, S_d, S_g – progressing of the processes that specify a partial order of execution; InD – input process information objects; InG – input process graphical objects; $OutD$ – output process information objects; $OutG$ – output process graphical objects.

The set of processes for constructing and processing information include high-level functions that form an image (raster representations of objects, visible contours of objects, etc.), approximate to piecewise linear functions (graphical representations of objects, indicators, etc.), functions for processing input data, functions of forming control packets and others. The set of information objects $D = \{d_i\}$ includes incoming data packets, variables and their structures associated with controls, intermediate data stacks, generated data transfer reports, and others. A collection of graphical objects $G = \{g_i\}$ are presented in the form of a set of indicators (graphical, arrow, scale, numeric, etc.) and control objects (I/O elements, status indication, display of line variables, etc.).

One of the main components of a graphical model is the concept of graphical attributes. Attribute sets describe the basic properties of graphic objects, such as line style, line color, outline dimensions, and background color. The graphic attribute model can be described as follows:

$$A_g = \langle C, F_c, N_c, T_c, n_c, t_c, InC, OutC \rangle,$$

where $C = \{c_i\}$ – a set of graphic attributes; F_c – graphic image; N_c, n_c – a set of graphic attribute names; T_c, t_c – a set of graphic attribute type names; InC – a process that requests the attribute value; $OutC$ – a process of the graphic object requested attributes set initializing. The model of graphic resources is made in a similar way:

$$A_r = \langle R, F_r, N_r, T_r, n_r, t_r, InR, OutR, DelR \rangle ,$$

where $R = \{r_i\}$ – a set of graphical resources; $DelR$ – a procedure of graphic resource visualization.

During the design of the conceptual model of an operator's automated workstation (AWS) of the SEPP parameters monitoring system, shown in Fig. 1, certain types of objects were used, which include graphic primitives, resources and attributes. To simplify the analysis of this model, domain templates were used. They are represented by separate fragments of the model and built in relation to the selected processes, taking into account the interaction with others.

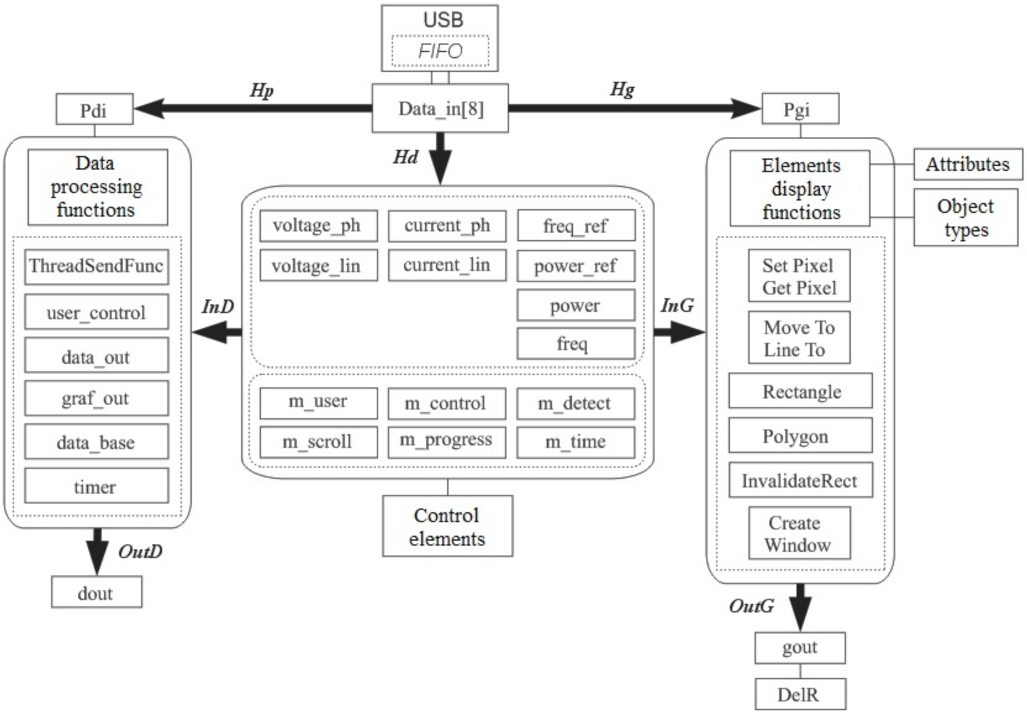

Fig. 1. The conceptual model of the SEPP parameters monitoring system

Analyzing the structure of images for each individual process, the following dependencies of the output graphic objects can be formulated:

– the source image for this process is the only one, the types of process and image hierarchies are the same;

– the original image corresponds to at least one process for which at least one image component is input;

– components of an image that is strictly input with respect to the template cannot be source images of sub-processes;

– any subprocess can have no more than one source image;

– the original given process of the template corresponds to at least one component that is input to the subprocess;

– any data that interacts with sub-processes is either components of the process input and output data, or local data that is used to transfer information;

– data components that are strictly input to a process cannot act as input to sub-processes.

Based on the above dependencies, the conceptual model of operator's AWS of the SEPP parameters monitoring system is regular. Passage in a regular conceptual model is associated with redundancy of the model, introduces the simultaneous use of relations of passage of processes S_p and images S_g. The visualization of images depends on the passes priority, because they indirectly determine the processes execution order. Transmission relations are inherited by all image components.

Taking into account the conceptual model, an analytical model of the operator's AWS was developed, which is a tool for assessing its completeness and consistency, and is used to determine the relations and types of connections between control and visualization subsystems. In Fig. 2 the model of the GUI element is shown, which is a mnemonic symbol for displaying the effective value of the generator phase current.

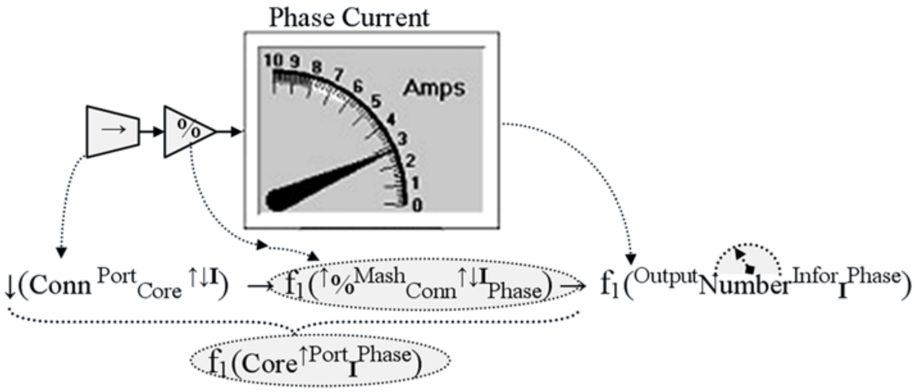

Fig. 2. Graphic-analytical model of the GUI element

In Fig. 3 a generalized model of AWS of the SEPP parameters monitoring system is shown.

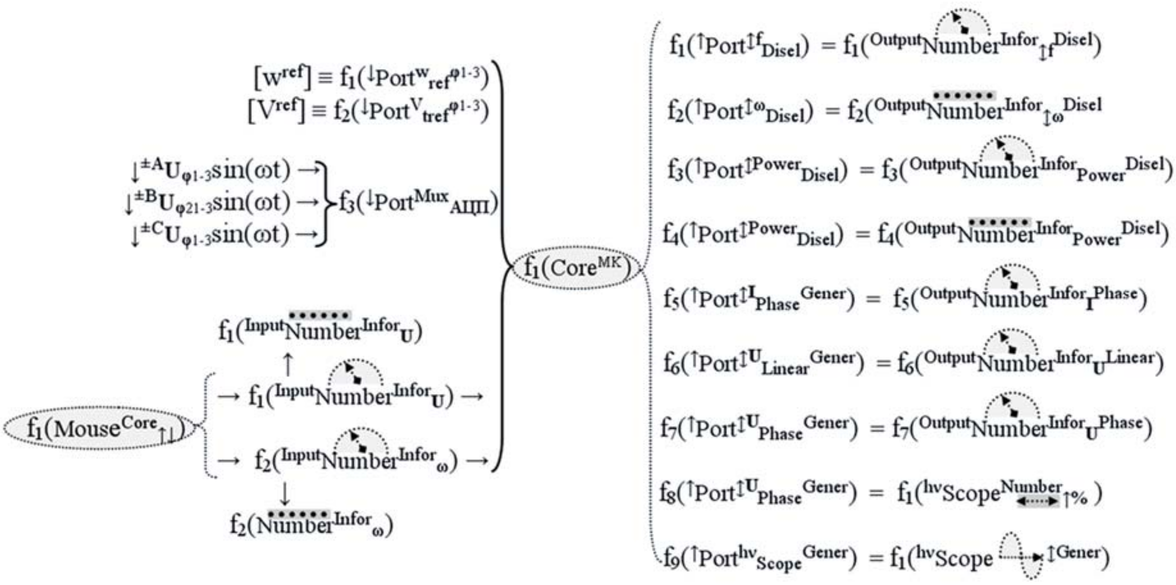

Fig. 3. The analytical model of AWS of SEPP parameters monitoring system

The use of the conceptual model allows to analyze the image processing and output processes, reduce the number of performed operations by excluding identical functions, initially compare the processes progress and the organization of unstructured data, distribute resources and operations performed on separate threads, reducing the load on computing resources. Such organization of the software package significantly increases the speed and reliability of the SEPP monitoring parameters system.

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DYNAMIC RESPONSE ANALYSIS OF MOB CONNECTOR

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Abstract: Based on the rigid module flexible connector (RMFC) model and the potential flow theory, the three-dimensional hydro dynamic response of 7 mobile semi submersible mobile offshore base(MOB) is calculated, considering interaction between modules. The connector loads are calculated in the frequency domain under the regular wave and irregular wave load cases, and we also compare the connectors' loads under different connector stiffness. The numerical results show that the wave direction, wave frequency, connector stiffness and sea conditions have obvious influence on the connector load. The calculation method and results of this paper can provide theoretical basis for the design of the connector of very large floating structure(VLFS).

Key words: MOB; multi floating body; connector load; connector stiffness.

Introduction

VLFS (very large floating structures) has become a hot research direction of marine engineering. Different from general large ships and offshore platforms, the scale of VLFS can reach thousands of meters. In the design sea state, it can float stablely at sea and provide living and production space. Compared with other marine development projects (such as reclamation), the selection of super large marine floating structures for marine development has obvious advantages. It has the advantages of mobility, less earthquake impact, less impact on the environment and good economy. In recent years, China has invested a lot of money and gathered the strength of domestic scientific research institutes, large shipyards and well-known universities to study the related technologies of very large offshore floating structures. The main research directions focus on hydroelastic mechanical properties, hydrodynamic properties, system design, structural design, connector design [1].

Mobile offshore base (MOB) is composed of multiple floating bodies, which is a typical form of VLFS. It is mostly applied in floating military logistics base, offshore floating airport, Floating Wharf, offshore floating oil reserve base, deep-sea oil production platform, floating supply base, floating artificial island, etc. MOB works in the deep sea, which bears large wave loads, resulting in significant relative motions between modules. Therefore, the connectors which are used to limit the relative motions between modules will bear huge loads. In this paper, the dynamic response of MOB is studied by using RMFC model, and the loads of connectors with different stiffness under regular and irregular waves are calculated and analyzed. At present, how to design connectors with excellent mechanical properties so that mob can survive in bad sea conditions is an international problem. The results of this paper can provide some reference data for mob flexible connector design and module seakeeping design.