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Network Services for Active Learning Computer Systems Design

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CDIO Initiative involves active learning in the project team. To carry out projects in the limited time needed program–methodical complexes. An example of a multi–level complex developed by COD – Conceptual Object Design, for multiple designing computer systems and automatic evaluation of resources for local installation and a network services.

Keywords: CDIO, COD – Conceptual Object Design, modular, multivariate, educational – research CAD.

Сетевые сервисы для активного обучения проектированию вычислительных систем

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Инициатива CDIO предполагает активное обучение в проектной команде. Для выполнения проектов в ограниченное время необходимы программно-методические комплексы. Приведен пример многоуровневого развиваемого комплекса COD – Conceptual Object Design для многовариантного проектирования вычислительных систем и автоматической оценки ресурсов для локальной установки и в виде сетевых сервисов.

Ключевые слова: CDIO, COD – Conceptual Object Design, модульная, многовариантная, учебно-исследовательская САПР.

Initiative CDIO (Conceive – Design – Implement – Operate) (Plan – design – produce – Use) recommends 12 standards (www.cdio.org), the eighth of which involves active learning in the project team.

On the upper level of abstraction (Fig. 1) is considered functional model systems as a whole, called Macromodel and output functions are described and transitions. At the next level of abstraction

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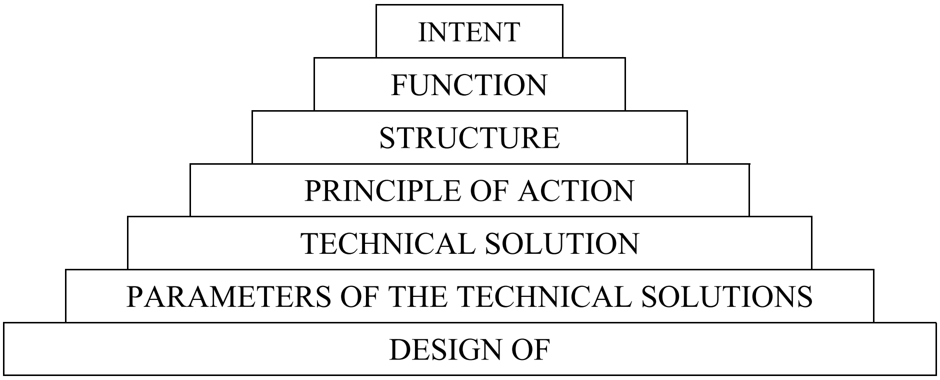

Fig. 1. Hierarchy of technical solutions at different levels of abstraction

are structural models, which reflect the internal structure of the components. These models will be called Micromodel.

One and the same structure of the computer system may be implemented using components with different principles of action. Perhaps comparison of variants of components with different principles of action. The processing subsystem may be implemented on one physical principles, and communications – other. physical principles of operation [14]. At the level of technical solutions can be roughly estimated resources: mass and dimensions, static power and switching energy, thermal characteristics, the environment and the permissible value.

The process of designing and testing a new object is iterative. In each iteration cycle project procedures performed synthesis, analysis and decision making. The result of synthesis, is an object description. The result of analyze is parameters, values of performance criteria and chart of objects behavior with external influences.

For simple analysis of the behavior of objects easier describe it, but the increasing complexity of objects behavior becomes very difficult compared with its description.

Industrial systems are focused on the engineering design and were closed [1, 3]. For training students and engineers were open systems engineers need training – research system of small modules.

The author was invited to an open educational — research CAD (ER CAD) computing Systems conceptual design (COD – Conceptual Object Design). Order of the Russian Ministry of Education 195 of 16.03.1987, decided to create training – CAD research in universities by industry, item of order 3.2.17 approved the proposal of the author.

ER CAD COD allows automatized estimation of concrete types resources. The resources estimation for the set of concrete type components for the multivariant analysis is possible. Any variable component type is the arrays of concrete values, with the dimension corresponding to the variants number (NVARMAX). Resources estimations are deduced for every single variant and for all variants in whole for every formalized task analysis. The performance criterion determination the performance evaluation in mbit/s is necessary. The value of the productivity is contained in the variable of the float type PP. This increases the productivity of students and engineers and becomes real active learning in the project team.

Program–methodical complex COD [36] is used for training students and training of engineers in small project teams with individual work rate. Teaching material in the form of lectures and presentations control issues assignments are on a web server in the system Moodle (ms.sfu–kras.ru). Completing quests possible on the local machine or on application servers. The rapid development of mobile Internet devices stimulates the development of CAD network services that provide work at any distance and not on working time.

Heterogeneous computing systems are a combination of data processing and data transmission from various forms of representation and supports [15].

Layered CAD COD (Conceptual Object Design) is used for the synthesis and analysis of multiple variants of structures and the automatic conversion of formalized task in graphic displays for decision, industrial design solutions for CAD. COD is composed of a plurality of subsystems of [4, 6].

$$COD = \langle HSC, COMM, SAT, AAT \rangle$$

where: HSC (Human Control) – management subsystem design, serves to reduce the burden on the person in the transition to the second level of the complexity of the design ;

COMM – communication subsystem design. Provides the ability to design objects on the Internet;

SAT (Synthesis Automation Tools) – tools of automated synthesis of objects;

AAT (Analysis Automation Tools) – tools, automated analysis of behavior, resource assessment and comparison of objects.

WEB servers (WS) provide training materials and links to application servers (Application Server – APS). For example, WEB server WS1 provides training in the system MOODLE (ms.sfu–kras.ru), and WS2 – just teaching materials. Application servers are used to perform formalized design assignments (FZ). The result of the FZ are network services containing timing diagrams of object behavior, the set of project files or macros for specialized or complex CAD. Application servers can be connected with equipment (HW) using devices and procedures ADCUSB. ADCUSB devices contain digital–analog and analog–to– digital converters. Servers are implemented on virtual machines DATA center SFU and use resources only when they are accessed.

Mobile personal laptops are represented (IPC – MPC), handheld (PDA – PPC), tablet (AUC – TPC) and communicators with a wireless connection to a data network (TEL). The advantage of mobile is easy to use in the workplace, and lack of need for adaptive display products.

Software workplace defined group of users. To view the project are free programs. Perform macro files is only possible in a full CAD package. For training students and teachers with free versions of CAD, sometimes with a limited number of components. Full version for training provided by the firm AUTODESK. AUTODESK REVIT provides a comprehensive, multidisciplinary building model. Collaborative learning requires a training license. In other cases, requires a commercial license. It may therefore be the optimal structure with a dedicated work space with full CAD files to run macros and only shipment of finished projects.

For decision–making and synthesis of objects in complex software methodical COD SFU formalized description of objects (FZ) are formed with automatic timing diagrams comparing perceived and actual signals and parameters table optimality criteria, concepts and images of objects

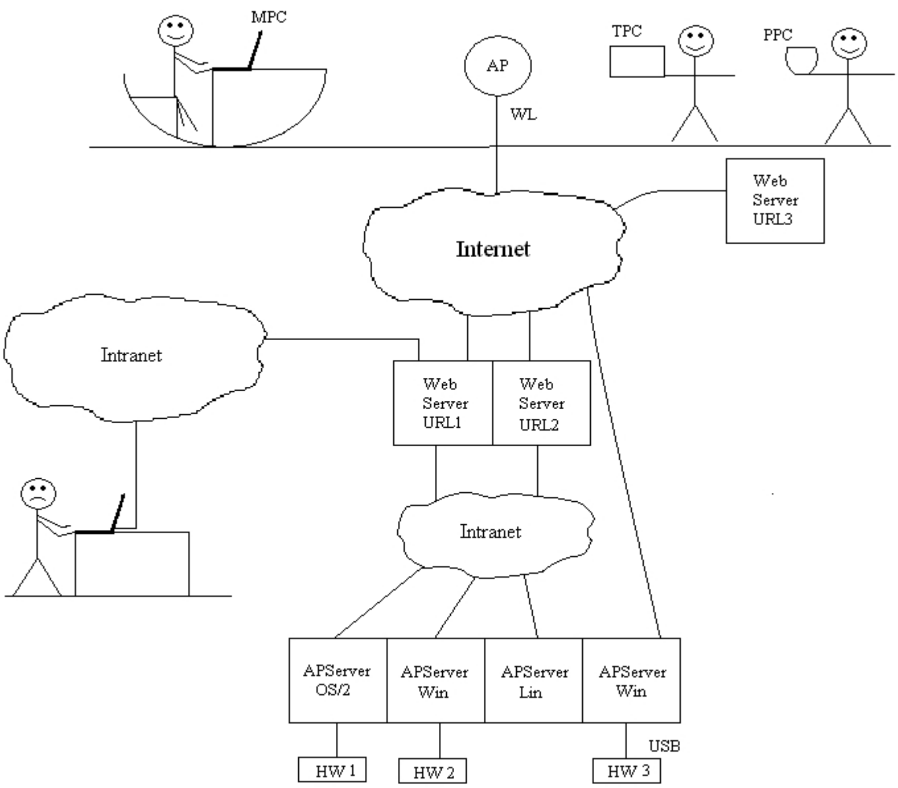

Fig. 2. Version of described system

for all variants. Constructs on component digital signals can be displayed and the temperature. To go to the engineering design FZ is converted to a specific system design.

When describing a set of solutions for low–level language descriptions amount equal to the power set of solutions, and in the description of high–level languages in one description can be a lot of solutions. The rationale is to describe high–level language set of solutions for a class of computing systems or devices.

For structural optimization required performance criteria [1, 6]. For stationary computing criterion of effectiveness is the cost per unit of performance. Mobile objects, such a criterion may be the mass per unit weight or performance of a computer system and a source of energy per unit of throughput. Similar estimates for a set of solutions are complex and time–consuming task for real solutions which require tools and information provision. Often used in a limited number of criteria, expressions for which are summarized in Table 1.

CAD user selects the desired result COD design or analysis using c subsystems PRJSEL, not a sequence of design procedures and operations to achieve the goal. This reduces the load on the user increases the level of intelligence and complex. Formalizable portion control subsystem design is presented in the form of shell CAD COD, which can be implemented by various means. Presented implementation skins for different operating systems based on multifunctional editor LPEX, tools included in IBM Visual Age, tools Eclipse, in the complex Web Sphere, and network browsers (Mozilla FireFox).

Table 1. The main criteria of optimality computing systems

Criteria	Dimension	Expression	Sphere of application
Unit cost performance	Relative cost / MIPS	К = C / P	General–purpose computing systems
Weight per unit performance	g / MIPS	К = M / P	Board computing system
Power and mass per unit performance	W / MIPS · g / MIPS	К = M/P · PF/P	Portable Computing systems

HSC subsystem design management consists of multiple subsystems

HSC = <SETSEL, PRJSEL, RESSEL, RPRJ>,

where: SETSEL – subsystem selection formalized job description languages of the project, the choice of CAD and type descriptions for import CAD and select the type of interface for export, the language used and the server in the network;

PRJSEL – subsystem selection results of design ;

RESSEL – subsystem selection presentation of results ;

RPRJ – rules corresponding to design routes, determine the choice of a sequence of design procedures and operations to obtain the results of design and analysis. With the development of the complex increases the proportion of rules implemented in the synthesis and analysis of subsystems.

Subsystem design choice results PRJSEL represented as

PRJSEL = <SETCADOUT, SETINTF>,

where: SETCADOUT – the set of admissible output CAD

SETINTF – set of interfaces used for the output of CAD.

Choice of representation subsystem design results RESSEL represented as

RESSEL = <VIEWTXT VIEWAD, VIEWSCH, VIEWMOD, VIEWNET>

where: VIEWTXT – viewer messages for one or multiple options

VIEWAD – many viewers diagrams digital and analog signals for multivariate analysis,

VIEWSCH, VIEWMOD, VIEWNET – many programs display circuits, modules and networking facilities.

Set of design rules RPRJ consists of subsets

RPRJ = <RNAMEVAR, RMCADIN, RMCADOUT, RFTSCH, RFTAB>,

where: RNAMEVAR – rules education options names the results of design ,

RMCADIN – rules for the selection of modules and functions fill the table option scheme

RFTSCH – rules for the selection of modules and functions extract data from tables option scheme

RFTAB – rules for the selection of modules and functions retrieve data from a table of information about the components of the scheme, RMCADOUT – rules for the selection of modules and functions filling option scheme specific CAD.

The subsystem selection SETSEL initial design data consists of a plurality of subsystems:

SETSEL = <SETPR, SETCADIN, SETTYPD, SETLANG, SETSERV>,

where : SETPR – subsystem project selection in the form of formal jobs

SETCADIN – select input subsystem CAD

SETTYPD – species selection subsystem descriptions in the input CAD

SETLANG – language selection subsystem project description

SETSERV – subsystem selection of application servers to implement projects in the form of formalized tasks and achieve results.

A plurality of input CAD (MCADIN), species descriptions in the input CAD (MTYPD), project description languages (MLANG), application servers to implement projects in the form of formalized tasks and achieve results (MSERV) have a small dimension with minor modifications. Unlike other sets, many projects MPRFZ expands and menus is not optimal. Best results are obtained by keyword search using the language SparQL. To find used free library containing java script, and formalized in each project task is inserted comment keyword [36]. The result is only formal job required projects.

The basis of the automatic conversion of a formalized description of the specific tasks in CAD models are feature–rich component with a common interface [4]. The presence of component models with a common interface allows you to convert formal job in the results for various applications. Depending on the application component models are synthesized and control modules. Model components and control modules are combined into static and dynamic libraries and are selected depending on the type of application. In order to reduce the complexity of creating models of components and control modules, models at different levels. Top level models pass parameters mid–range model, and model the average form sections of the output file using the model of the lower level. Top–level model is not dependent on the type of application. Type of application models defined middle and lower levels.

Dataware subsystem AAT automatic behavior analysis, resource assessment and comparison is presented in tabular form. Table BRD.dbt constructs used to represent modules, the table settings are PAC.dbt konstruktivov component tables UIPCAD.dbm (Dbt) is basic information about the names of the component documents, settings, types of findings and components. Information provision is used in the form of XML files.

To form a plurality of results used only description and creates a table version of a composite object. For specialized CAD Altium Designer, PCAD generated schema files and batch files, and for complex CAD CATIA, AUTOCAD REVIT only batch files constructing the object.

References

[1] *Norenkov I.P.* Fundamentals aided design. Textbook for high schools. Moscow: Publishing House of the MSTU. Bauman, 2006. 440.

[2] *Artamonov E.I.* // Information technologies in designing and proizvodstve. 2008. N 2. P. 3–10.

[3] *Borde B.I.* Fundamentals CAD heterogeneous computing devices and systems, Krasnoyarsk, ed. KSTU stamped Ministry of Education, 2001. – 352 p.

[4] *Borde B.I.* // Proceedings of the International Conference of CAD / CAM / PDM – 2012. Moscow: Institute of Control Sciences, 2012 P. 242–244.

[5] *Borde B.I.* Software – methodical complex Fundamentals CAD heterogeneous computing devices and systems. Krasnoyarsk: KSTU, 2007. – CDROM (Russian, English). Registration INFORM REGISTER 0320702238.

[6] *Borde B.I.* // Bulletin of the Krasnoyarsk State University, Physics and mathematics, 2006. N 7. P. 155–161.