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SOFTWARE INTEGRATION AT THE COMPUTER-AIDED DESIGN OF WIND POWER PLANTS

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Abstract— *It is developed software integration of different computer-aided design systems in the design of wind power plants. The block-diagram of computer-aided design system is presented.*

Index Terms— computer-aided design; wind power plant; structure scheme.

I. INTRODUCTION

The need for the development of wind energy in Ukraine due to the following reasons: shortage of fossil fuels, the increasing cost of energy, continued environmental degradation. In addition, the use of power plants (PP) as independent sources of energy to consumers, far from thermal power plants is a useful social and economic impact of energy for small farmers and other rural households in terms of the current economic situation in Ukraine [1] – [3].

To date, there is need to look for alternative sources of cheap energy instead of using traditional fuels. The wind potential of the planet is large enough. According to the World Meteorological Organization, wind power is 170 trillion kilowatt hours per year, it is several times more than the entire production of electricity in the world today.

However, despite the considerable potential of wind energy in Ukraine it is only in its infancy and is represented by several wind turbines in southern Ukraine.

The average wind speed in the surface layer in Ukraine is quite low – about 4 m/s. However, estimates of wind potential at an altitude of 50 meters above the ground show to 330 billion kWh (which exceeds the capacity of power plants in Ukraine 6 thousand times).

Computer-aided design allows you to carry out the design in automatic mode and involves solving the following task: construction calculation to ensure maximum intake factor of wind power and the possibility of efficient operation at wind speeds below 2 m/s. The problem is to create an installation that is both effective in low winds of Ukraine and at the same time cost-effective in the production of energy. It should be divided into two separate sub-tasks – development Darrieus rotor that produce user-defined power and development of Savonius rotor that will ensure the largest possible reduction in starting torque of the total installation [4] – [7].

Below in Fig. 1 shows a block diagram of computer aided design installations [8].

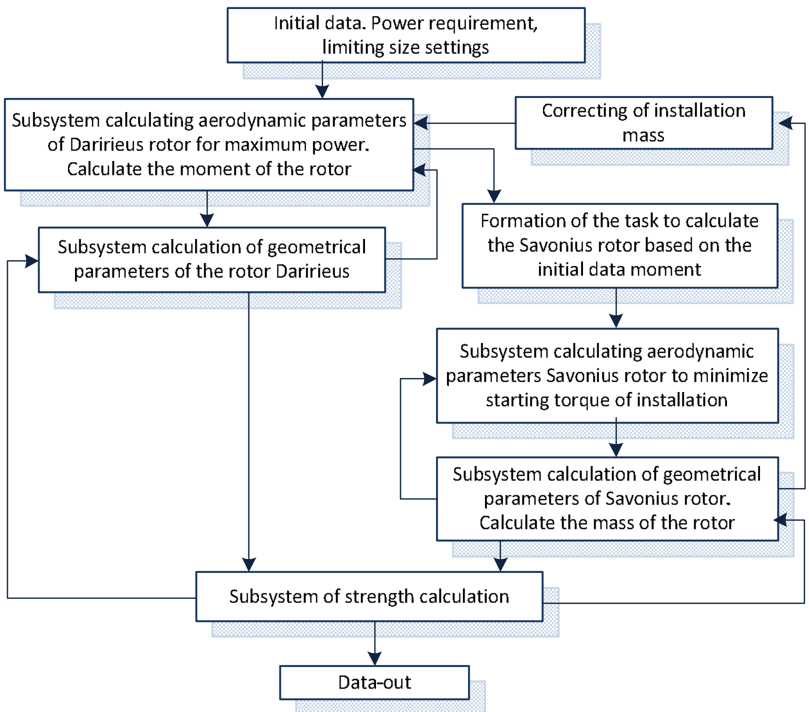

Fig. 1. Block diagram of computer aided design installations

II. THE SOFTWARE

Applications are made in the software package from Oracle. The project itself is made in the programming language Java due to the ease of integration programs written in that language, with different control systems. Thus the rank, the same code can be run under the operating systems Windows, Linux, FreeBSD, Solaris, Apple Mac, etc. This becomes very important when programs are loaded through the Internet and are used on different platforms. The first stage of work is to calculate the output parameters of the Darrieus rotor. Thus the main input parameter is the output of powerful rotor. Next, the program will perform the optimization of the parameters of the rotor Darries and display all possible structures that satisfy the input parameters. The next stage of the program is to calculate the Savonius rotor for maximum available geometrical parameters (height and width are limited size of the Darrieus rotor). The main output parameter is the starting moment whose value should be maximized to ensure minimal rotor momentum. After optimizing the parameters of both rotors it is necessary to recalculate starting torque and output power for both units.

*Problem statement***.** Today, there are dozens of software products designed to meet the challenges of each stage of computer-aided design. Therefore, there is no need to deal with each individual task to create new software components that can solve such problems. From an economic point of view and from the point of view of simplicity of design makes sense to combine existing software products in an integrated suite of software products for the task.

*Method of solution***.** To achieve this goal it is necessary to solve the following problems.

1. Choosing N software (*W*1, *W*2, *W*3, ..., *WN*), sharing which can solve the problem of automating the design of a product.
2. Methodology CAD design from the standpoint of redirecting information flows.
3. Integrating data in a single information process.

The first stage is unique for each separate task and depends on the capabilities and preferences of the customer, hence there is no optimal algorithm for solving this problem. Here an individual approach is used.

Standard business requirements:

– guaranteed delivery of messages and single;

– reliable operation with network, software and hardware faults (fault tolerance);

– high performance;

– short development cycle for the integration project;

– the ability to easily build and reuse components;

– low cost of ownership and maintenance of the system.

Standardization of data as a:

– standard message, body accepts standard XML;

– standard interface, description system accepts standard XSD;

– standard, modified standard XML messages accept XSLT;

– first access to the message body language, take XPATH.

These standards are well established and have wide support.

In practice, not all systems support XML-interface for data exchange. In this case, it is necessary to use ASB transformation services message format in XML-messages (Fig. 2).

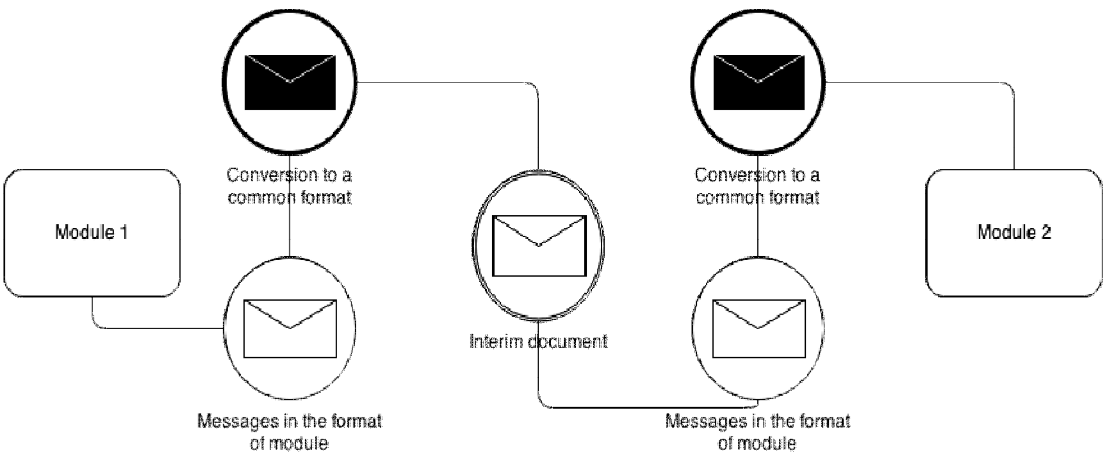

Fig. 2. Format conversion mechanism

If *C*1 and *C*2 formats – not XML, converters may be a specific software product. Nevertheless, even in this case, the conversion from XML in a simple straightforward format (e.g., comma delimited) can be performed using XSLT-transformation. Steps to change formats you can easily make at the ASB level. Received by ASB data will be converted to the intermediate XML format, and the output will be converted to the format of the recipient. Application systems themselves do not need to be reworked in this regard, because all conversions are performed at the level of ASB.

If the format is XML, the conversion can be performed by means of XSLT transformations.

The most common mode of transmission was and is still is working through the files. Some systems for interaction do the following: perform a data dump of $C1$, file transports by mail or through the carrier and loads into $C2$, and all operations are performed manually. This process does not meet the requirements of modern business.

File should be available for adapters that will pick up a directory of files and send them as messages to the server message queue of ASB. In addition, they must be configured to accept messages from the server. The best option is invariant to the OS adapters, for that purpose are perfect adapters, written in JAVA. Invariance of the software is very important because there are many products that work not only on Windows, but also on Linux, AIX, Sun Solaris, and others. Mostly, it does not matter which operating system is required for the server messages.

Having defined the general scheme of interaction modules, you must determine what kind of formats and data types used in today's CAD systems.

III. CONCLUSION

Presented CAD with an integrated environment introduces a new approach to managing the design process. Used in the proposed medium scenario design can greatly simplify the work of the designer. Available in medium monitor provides the flexibility of design processes with a flexible structure description of design procedures in the scenario design. Properties listed above for such CAD, coupled with the ability to integrate data of various aspects of presentation in a single information process, this system is isolated in a special class of software employed to integrate heterogeneous data.

However, investigated CAD with integrated environment does not have sufficient properties to assign a class to its CAD implementing dynamic data integration. This system is a tool for creating applied (final) CAD. The system has all the advantages presented only in the process of creating the ultimate CAD. During the operation created the ultimate CAD provides the designer the opportunity to log only project operations not provided for scenario planning.

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В. М. Синеглазов, А. В. Кульбака. Програмне забезпечення інтеграції під час автоматизованого проектування вітроенергетичних установок

Розроблено програмне забезпечення інтеграції окремих систем автоматизованого проектування під час проектування вітроенергетичних установок. Представлено структурну схему системи автоматизованого проектування.

Ключові слова: автоматизоване проектування; вітроенергетична установка; структурна схема.

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В. М. Синеглазов, А. В. Кульбака, В. Н. Бойко. Программное обеспечение интеграции при автоматизированном проектировании ветроэнергетических установок

Разработано программное обеспечение интеграции отдельных систем автоматизированного проектирования при проектировании ветроэнергетических установок. Представлена структурная схема системы автоматизированного проектирования.

Ключевые слова: автоматизированное проектирование; ветроэнергетическая установка; структурная схема.

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