МАШИНОСТРОЕНИЕ

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KEY BENEFITS OF VIRTUAL TECHNOLOGY

Specialized robotic workplaces or systems are not only a complex issue, but at the same time they are financially demanding in the field of production, especially, when the prototypes essential for mechanical engineering or forestry are concerned. Such a robotic workplace calls for an original project of a small series production and the proposed virtual environment meets the requirements for the verification of the technological properties, reliability and construct possibilities of the prototypes. The specialized robotic workplace is an interactively described 3D object and is programmable in accordance with the real environment requirements. Virtual technologies represent an convenient solution for the preparation of a safe ergonomic, economic and environmental workplace.

Keywords: robot, virtual, workplace, animation

1. Introduction

Economic and global trends in mechanical engineering management in the Slovak Republic are heading to maintain the related EU conditions aimed at the sustainable development of the machine engineering production. These technologies related to the effectiveness of national economic development in accordance with the EU countries´ machine production management are accepted in the project phase of the new specialized robotic workplace. Authors focus on the implementation of the results in forestry.

In praxis of technology workplaces with robots the computing technology is used. It is important the used technology to be independent to platform on which it will be presented and to use the newest standards in computer technologies. The aim of our project is to design suitable technology to implement computer model of virtual technological workplace. The result will be to teach and test manipulation control operations. Virtual workplace model simulates simple logics derived from real robotized workplace.

2. Virtual control systems

It is obvious, that the information acquisition at real technical means of the control systems is financially demanding. The basic training for the plant and its structure´s project engineers is available at the control system supplier, and limited renewing courses at the customer´s control system. However, the principle problem lies in the operators´ preparation for emergency situations of the plant equipment. Virtual control systems connected with virtual models of control systems mean an effective solution of the abovementioned problems. Current research results and further research development in the field of virtual control systems implementation are supported by VRML /Virtual Reality Modeling Language/, designed for interactive description of 3D objects and worlds.

2.1. VRML for virtual concepts

VRML /Virtual Reality Modeling Language/ is designed for interactive description of 3D objects and worlds. It is also a universal variable format for 3D graphics and multimedia. The use of VRML can vary and comprises also the possibility of technical and scientific visualization, multimedia presentations, entertainment, computer-aided education, www pages and virtual worlds.

It is a standardized file system defined by ISO/IEC 14772. VRML is capable to represent static and dynamic (animated) 3D objects, multimedia objects with hyperlinks for individual components of multimedia, such as a text, sound, picture, animation and film. VRML was designed to meet the following requirements:

The possibility to create automated scripts. It allows for the development of computer programs for the VRML creation, editing and operation based on automated translation programs for the conversion of other common 3D formats into VRML files.

The arrangement provides the ability to combine dynamic 3D objects and VRML worlds.

The spreadability allows for the addition of new objects not explicitly defined in VRML

Performance

The scale allows for the development of arbitrary large dynamic 3D worlds.

3. Basic principles of virtual robotized workplace

The main aim of automated laboratory modeling is simulation. It offers wide range of industrial robots use possibilities, enables to use the whole kinematics, which could not to be used in real robot because of manipulation equipment damage risk. The concept of virtual laboratory automated workplace has following advantages:

1 – decrease of risk in complicated and dangerous robot manipulations unlike in manual control,

2 – more transparency in robot control,

3 – elimination of the need to travel to the place of manipulation equipment and connected expenses,

4 – accessing the industrial robot control to students without access to control the real equipment,

5 – creating fully functional application that amends manual control in virtual form,

6 – the possibility to make various simplifications in control,

7 – instant availability at any time,

8 – the possibility to create components to expand the workplace periferies,

9 – the possibility to work anywhere and anytime,

10 – generating of various statistic results that will be processed from any time interval of virtual laboratory work,

11 – more easily setting of work in various working modes,

12 – various perifery corrections and manipulations,

13 – exchange of gained knowledge and statistics between workers and the possibility of broader data executing,

14 – creating of own programming interface for more simplification.

Additional important positive is creation of such program automated laboratory control environment which fulfills all ecology, ergonomic and functional conditions.

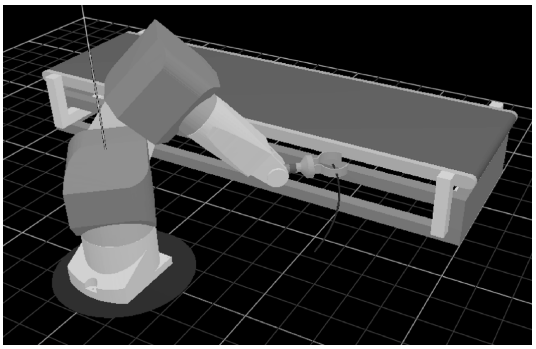

Fig. 1. Virtual scene of a robotic workplace

4. The decision process for simulation algorithm definition

By the CNC program design as well as by the robots programming on the virtual scene, there are situations when for some machines it is necessary to wait for a defined time period. The movement speed, either angle or translation speed, represents the time function. It is essential to use the simulation algorithm controlled by events. For example: figure 1 shows the real scene of a robotic technological workplace with the possibility to program the technological process of materials manipulation.

4.1. Some advantages of virtual control systems

The training in control system real technical means is financially demanding. The basic training for the plant and its structure´s project engineer is available at the control system supplier, and limited renewing courses at the customer´s control system. However, the principle problem is represented by the operatiors´ preparation for emergency situations of the plant equipment. Virtual control systems connected with virtual models of control systems mean an effective solution of the abovementioned problems.

The development process based on virtuality is at present a prerequisite for the successful process of a new product or workplace creation. In the phase of project, there exists the concept of a virtual robotic workplace model with the possibility do design real technology and define the basic principles of the technological process control system. The implementation of virtual methods in this paradigm is highly effective and leads to early decisions of real workplace effectiveness from various aspects. The original idea of a virtual technological workplace project was based on a know-how workplace. It is similar to the constant education level increase not only at universities - where it is necessary to implement new technologies into education.

5. Application and interface

Animation as a significant part of the application illusatrates the current state of all units and parts of the robotic workplace. It is impressive not only by the manual control but also by the data processing.

The animation will be carried out by the means of object oriented Microsoft visual C+ with the use of graphic library Open GL, both providing wide possibilities of the use of a large number of orders and functions. Library Open GL is compatible with Linux operation system and represents a standard in 3D graphics. Iterface has to be compatible with the data processing generated from the virtual scene, then transformed into the real environment of a robotic workplace.

5.1. Application interface design

In the design phase it is important to define the interface between application and user. Additional important condition of clear control is the user not to be cluttered up with a lot of control elements. There should be few control elements and also function should be clear at the first sight. In application of virtual automated workplace will be many control elements but will be ordered and integrated in the environment so that the usability will be unassuming, clear and fulfil all the user requirements.

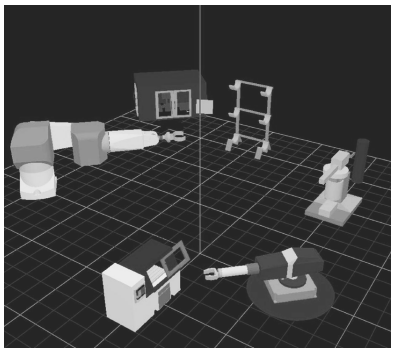

Fig. 2. An example of a virtual scene creation

Communication interface: in particular project parts the following standards will be used. VRML 97 for virtual scene definition, COBRA 2.0 for assigning server vs. client communication, JAVA for programming of platform independent application.

It is important to design model parameters to be possible to expand it by adding parameters.

6. Proposal of the boundary application

In the phase of the proposal of the boundary application, it is essential to define the boundary between the application itself and the application user. The ergonomics of the boundary application is an important point, i.e. the simpler the control the better. Another important condition of an application control overview is represented by the smallest possible number of control units for the user.

In the simulation application in Fig. 2 of the virtual robotic workplace, there will be many control units but they will be arranged and implemented in such a way so that they are user friendly.

6.1. Application control

It is necessary so that the application control is unified as a whole and that there is one control unit per function. Individual control units will be called by names or abbreviations and the control will be assisted by a helper.

7. Conclusion

The new possibilities of specialized robotic workplaces design, project, implementation and management allow for the simulation of the use in the project phase while meeting economic, ergonomic and sensitive environmental requirements accepted in EU countries at the same time.

It is still clear that the information acquisition in real technical means is financially demanding. The basic training for the plant and its structure´s project engineer is available at the control system supplier, and limited renewing courses at the customer´s con-

trol system. However, the principle problem is represented by the operators´ preparation for emergency situations of the plant equipment. Virtual control systems connected with virtual models of control systems offer a convenient solution of the abovementioned problems.

By keeping basic standards of information transmission and accepting sufficient transmission speed it is possible the student will train manipulation sequence on remote workplace. It means finance saving, it is not needed to build several robotized workplaces physical models but only model in computer and connection to software simulators.

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Виртуальная технология и ее эффективность

Применение специализированных роботизированных рабочих мест и систем экономически оправдано в производстве. Приводится виртуальная технология, позволяющая разработать опытный образец роботизированной системы для мелкосерийного производства. Технология учитывает технологические особенности и надежность разрабатываемой системы. Представлена трехмерная модель роботизированного рабочего места с возможностью программирования в соответствии с реальными требованиями. Отмечается, что виртуальная технология позволяет решать экономические, эргономические и экологические проблемы.

Ключевые слова: робот, виртуальная технология, рабочее место, анимация

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