



## USAGE OF VIRTUAL REALITY IN DISASSEMBLY PROCESS

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### ABSTRACT:

Nowadays virtual reality is using in many areas of mechanical industry.

Worldwide is preferred ecological reasoning, whereby is given in forefront disassembly see out products. One of possibilities is a utilization virtual reality tool in disassembly processes. In disassembly is needed to awake that products consist of many materials that we know recycle and use again in production. That is very economical and ecological solution.

Variants of disassembly line is possible propose in virtual reality and than choose most favorable variant. In virtual reality we can propose, modeling and simulation disassembly workstation previously that it will be built in real.

### KEY WORDS:

Virtual reality, disassembly, optimalization of working movement

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## 1. INTRODUCTION

The disassembly process is scores of the time question under debate.

Environmental deterioration is high actual question and still discussed about efficiency production resources of products, which no-load on a large scale environment. The best way is production of products with condition of components use after end of life.

In principle every electric or electronic product consist of combination of the few basic units like circuit boards, cables, electric conductors and wires, synthetics containing inhibitor of burning, mercury switches, liquid crystal displays (LCD), accumulators, batteries, condensers, etc. Some of these components are possible to recover, that means recycle them in new production process.

## 2. DISASSEMBLY PROCESS

Industrial practice in product disassembly tends to be quite unstructured. Almost exclusively, disassembly is a manual activity, and the overall economics are still not well understood [5].

Disassembly process is possible to characterize as operations summary of disassembly parts from upper units, technically: as simple as possible and economical effectively. Disassembly invades unity of product construction with target to repeatedly obtain parts, rare materials, etc. For all that is needed to regard the fact, that parts can be worn out, rusted and otherwise damaged, and thereby useless in terms of product recycling.

Disassembly presents profession area, where predominate generally manual acts. These are difficult and hardly replaceable with machine operations. Disassembly process consists of disassembly operations, which disassemble final products on lower units and these on parts and materials. Disassembly process is realized in concrete technically and economically effective sequences. Parts of disassembly process are also preparatory, assistant and service activities that support all the process and rationalize it. Disassembly processes wage in concrete technical, technological, organizational and economical conditions.

Disassembly is created by predetermine logical steps. From progressive analysis of disassembly processes is possible to determine three general responsibilities of disassembly:

- ✚ Disposal of harmful and dangerous substances,
- ✚ Inquiries of constructive units or single parts for repeated usage,
- ✚ Separation of stuff fractions with establishment of material recycling.

### 3. USAGE OF VIRTUAL REALITY

After prepared analysis of disassembly processes is needed to work out complete technological procedure. For faster and more effective planning of disassembly processes is advantageous to use tools of virtual reality. In virtual reality is important work in real time for create as well as illusion of real world. The target of virtual reality usage is simulation and optimalization of disassembly operations still before application in practice or simulation and optimalization of disassembly operations, which are established in practice.

As noted previously, disassembly processes are mainly characterized by manual work. Therefore increase of efficiency and manual work productivity claims a solid analysis of enterprises, which are executed on working include determination of their impacts on human.

Technical and software resources of computing aids arrive in stage, when is possible to realize these analyses with way in past hardly thinkable [4].

For interaction of the user with virtual reality is used data glove (figure 1.). Data glove is able to transfer real hand motion into computer. Glove records position changes of fingers, but it is not equipped with sensors to determine total location in space. Total location serves tracker (figure 2.), which works on magnetic principle.

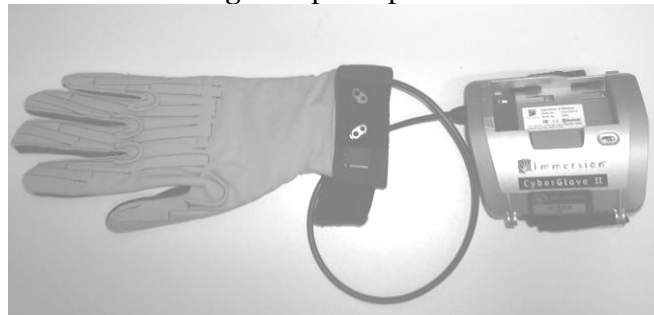


FIGURE 1. DATA GLOVE



FIGURE 2. FLOCK OF BIRDS DC MAGNETIC TRACKER

Data glove is very appropriate for transfer real hand motions into computer. By means of data glove is recorded a track and time of real hand motion of worker. These motions are possible to analyze and then propose optimal conditions of workstation for effective work.

In addition to data glove is needed to use one or more cameras for shooting of worker motions in real workstation. On the basis of measured dimensions of workstation and shooting motions is on-simulated performance of worker in virtual reality (figure 3) in program interface of CATIA. This program allows interaction with data glove.

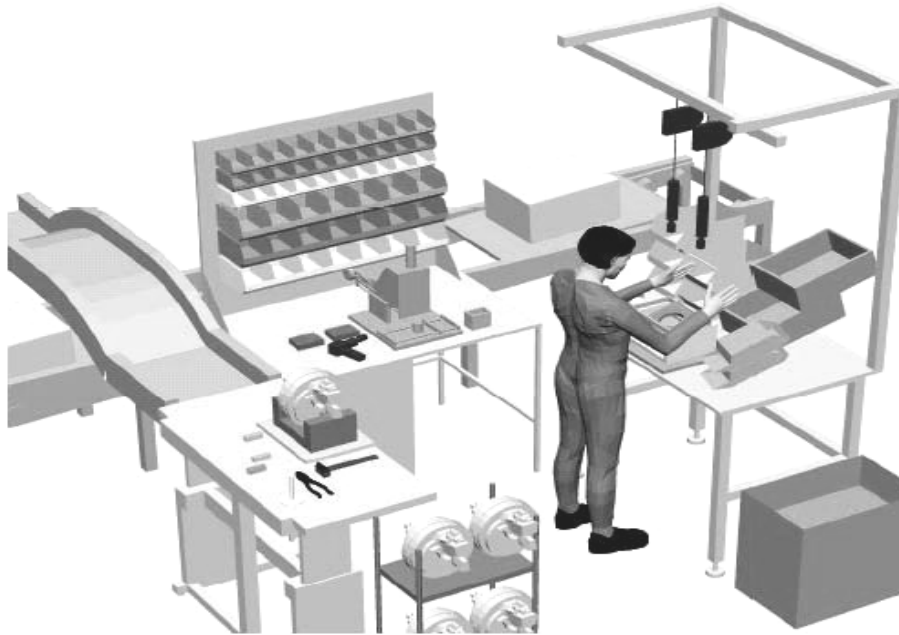


FIGURE 3. SIMULATION OF WORKER IN WORKSTATION

#### 4. ANALYSIS OF WORKING MOVEMENT

Before running of glove motion scanning is needed to measure initial hand position of worker on the bench. Reason is latter need of exact trajectory placing in digital model. Consequently is button camera, and then is button recording of worker hand motion in CATIA space and is make a disassembly process.

The next step is creation of 3D model of workstation in CATIA, which conforms real workstation dimensions. Into workstation model is placed virtual human, whose parameters correspond with dimensions of scanning worker.

On thus prepared model is possible to make analyses of individual phases worker hand motions. Analysis is performance in the tool of CATIA: Human Activity Analysis workbench. By means of this analysis is possible to determine favourable or unfavourable attributes of worker stress. Unfavourable attributes is possible to eliminate by reorganization of finding at workstation or by proposition of another working position.

Initial experiences obtained by this analysis indicate perspective way in the area of hand operation analysis. If there are compliance conditions of virtual reality usability, it is possible to effectively analyze the workstation of manual disassembly and consequently to optimize the workstation on basis of obtained results.

#### 5. CONCLUSION

Increase in productivity of manual labour in disassembly processes requires an active analysis of interaction human and workstation. One of the possible ways is to usage of virtual reality for this analysis. Data glove creates the model of hand and transmits the motion of real hand to virtual reality. Usage of data glove as a tool of virtual reality has a potential for analysis of hand working movement in terms of ergonomics, increase of working movement efficiency, reduction of human stress involved by unnatural position of hands.

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