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DESIGN OF AUTOMATED DISASSEMBLY PROCESS AS AN ELEMENT OF INTELLIGENT ASSEMBLY CELL

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Abstract: *Disassembly is new and also rapid developed trend in the manufacturing area. In the future the disassembly will be inseparable part of manufacturing process. Especially this fact will be important for that part of industry, which is focused to the products with variable nature. The nature of such variable products is changing following to the customer requests. Especially automated disassembly is a technology, which is attempting to satisfy such needs and requirements. Many of such special requirements are supported by international institutions, research programs and foundations. Automated disassembly technique allows automated separation of various parts, from which was disassembled product created.*
Key words: *Disassembly, Robot, Flexible, Step diagram*

1. INTRODUCTION

Creation and design of automated disassembly device is an complex problem, which includes design problematic of automated device. Of course automated device design problematic is consequently adjusted following to the requirements of disassembly devices design problematic. Such designing process, which is designing automated disassembly device needs some guide. This guide will carry designer over the all problems which are connected with disassembly process and also its automation. After using of such guide, some automated disassembly device will be designed. Such guide, or better say such tool is and methodology of automated disassembly devices design.

2. METHODOLOGY OF AUTOMATED DISASSEMBLY DEVICE DESIGN

2.1 Disassembled product analysis

Input of most manufacturing of assembly technologies is analysis of manufactured or assembled product. (Velíšek & Katalinič, 2004). The number of valuation views to the product and to disassembly device can be different, usually the number depends on complexity or largeness of whole disassembled block. Valuation views of disassembled product can be divided in the five groups: disassembled element analysis according to the recycling kinds of single building products, disassembled elements analysis according to its influence to the environment, disassembled elements analysis according to the design materials of disassembled products, disassembled elements analysis according to the using assembly joints or according to the used assembly technologies, dimension and shape analysis of single products, which are used during the whole assembly process. Information which comes from these analyses are then used for identification of parameters which are limiting the following disassembly process.

2.2 Disassembly process design

For proper disassembly process design is necessary to know, the process which was used by its assembly (Fig. 1.). From that reason we use, as an input for disassembly process design, assembly processes and other assembly documentation. If such information and materials are not available it is necessary to create own input data.

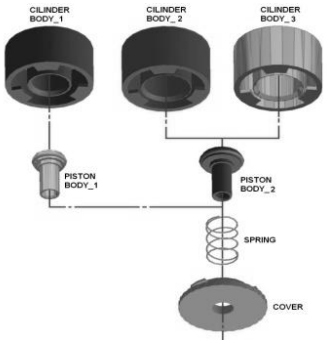

Fig. 1. Assembly process of pneumatic actuator

The tool which can be used for such input data creation is for example step diagram, which is added by information taken from assembly product joints analysis (Fig. 2.) (Javorová, A., 2008).

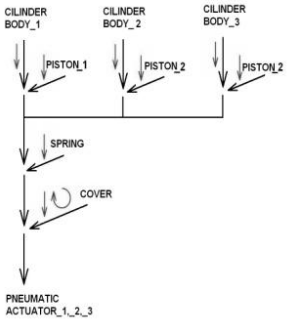

Fig. 2. Step diagram for assembly of pneumatic actuator

This way created assembly process can be later reworked by process of creating of reverse step diagram (Fig. 3.). In case of more complicated design, not only reverse step diagram can be used. This solution needs, because of complicated and large design, the creation of internal structure, which wills simple whole this kind created diagram.

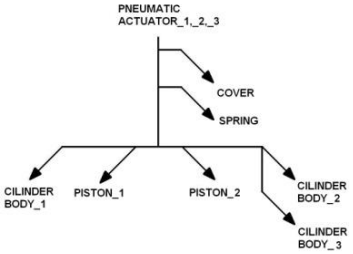

Fig. 3. Reverse step diagram

Diagram doesn't includes logical branching and conditions, which are needed for effective disassembly process. The reversed step diagram have to be supplemented by conditions and rules on the ground of Petri net theory (Brychta et al., 2008). This way created combinated disassembly diagram offers more information which can be used for design of automated disassembly device. This way created diagram also deals about need of sensors equipment, also shows basic movements which are needed for whole disassembly process and its also shows need of movement actuators which will be needed for realization of whole disassembly device. Diagram of this type was specially designed and created for needs of automated disassembly devices design methodology and is also combined by automated devices design problematic (Fig. 4.).

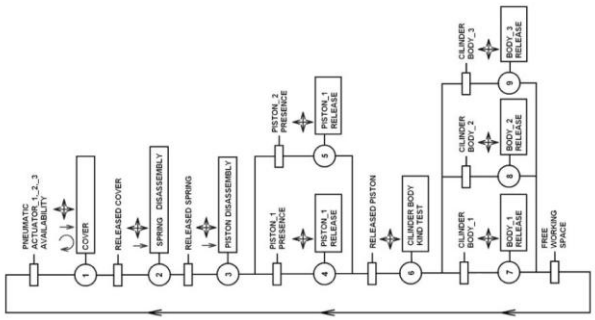

Fig. 4. Supplemented step diagram

Diagram in this version can be used for whole disassembly process description. It is also very important guide for design of whole disassembly device.

3. AUTOMATED DISASSEMBLY DEVICE DESIGN

Methodology solves the automated disassembly device design in several influenced levels. First two solution levels are the design of elements which are creating the working space of whole device and design of disassembly device manipulation device. As first one the problematic of working space is solved. This problematic deals about the number and also the character of manipulating and working places. Inputs, which are needed for this problematic are reversed disassembly step diagram.

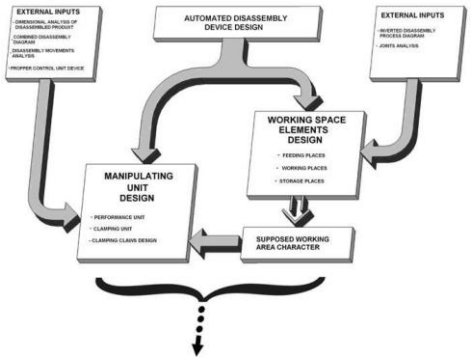

Fig. 5. Automated disassembly device design methodology ½

The output of workspace elements design is and creation of first working space picture, which strongly influence to the following design methodology of manipulating part of disassembly device. Design process deals about design of power unit, design of clamping units, design process of clamping jaws. On the ground of input analysis and step diagrams are defined parameters of methodology: load, dimensions, power, performance, man manipulating repieability, clamping dimensions e.g. Information which are coming from these starting methodology activities are also input data for other two activities: to the main frame and control unit design of automated disassembly device. The both activites are not influence one tho another. The end of whole automated disassembly device design process is characterized by activity called collision analysis that defines single zones created in the working space of the device such as manipulating zone, working zone, non usable zone, and so on. This activity defines the intersections of these zones and analyses possible collision stays (Mudrikova et al., 2008).

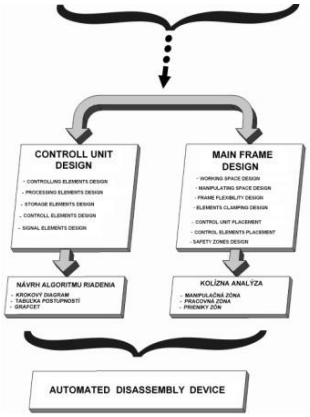

Fig. 6. Automated disassembly device design methodology 2/2

The next one activity of the design methodology is design of control unit that includes: the design of control elements, processing elements, storage elements, control elements and signal elements. Main area of this activity is focused on the design of control algorithm of automated disassembly device.

4. CONCLUSION

Designed methodology, step by step deals about single activities and works. Realization of such activities is necessary for complex design of automated disassembly device. Single steps are using known analytical project methods which are modified following to the disassembly devices problematic. But generally the methodology of automated disassembly device design stand on the methods which were specially created for needs of disassembly devices needs. Methodology includes before project as well as project phases, which are followed by design phases of whole automated disassembly device. (Zvolenský, R. & Ružarovský, R., 2008). By connecting of updated well known methods and specialized newly created methods a new methodology is created, and it is able to create working automated disassembly device.

5. ACKNOWLEDGEMENTS

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