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# JAW TYPES DESIGN AT THE INTELLIGENT MANUFACTURING-ASSEMBLY CELL

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**ABSTRACT:** In this contribution is presented a jaw types design at the intelligent manufacturing cell. This manufacturing cell is situated at the Institute of Production System and Applied Mechanics. The complex jaw types design is going out intelligent manufacturing systems knowledge's. Automated exchange system was designed with types of jaws in the intelligent manufacturing cell and after was designed the sensory system for gripper buffers. These sensors are used for identification of jaws.
**KEYWORDS:** system, design, mechanics, manufacturing, jaw, types

## ❖ INTRODUCTION

The industrial manufacture is still forwarding. Today we are not talking only about using of IT, classical automated instruments. But when we are talking about flexible manufacturing systems it is effective to talk also about possible using of new generation manufacturing systems. These new generation manufacturing systems are also called intelligent manufacturing systems (IMS). All IMS subsystems are including parts of so called machine intelligence (sensor equipment).

## ❖ CHARACTERISTICS OF FLEXIBLE MANUFACTURING AND ASSEMBLY CELL

At the Institute of Production System and Applied Mechanics is situated flexible manufacturing cell. During the design of intelligent manufacturing cell, there was very important to conserve two basic subsystems, such as was during flexible manufacturing cell design.

For presence analysis of gripper at the buffer are used inductive sensors. For identification of single gripper types following to their shapes, was designed identification system, which is using colour sensing sensors.

## ❖ EXCHANGE SYSTEM OF GRIPPER IN BUFFERS

At this intelligent cell are situated eight of grippers jaw types. By this exchange are used grippers of types MHZ2. Blanks, parts, tools, fixtures can to be of handling subjects. These elements are as working objects. Elements of handling are physical entity of different forms, from different materials with different complexity. These elements have exact parameters as dimensions, weight, and centre. On the fig.1 is to see different types and forms of parts. Different jaws of grippers will to handle with these parts at the intelligent manufacturing-assembly cell.

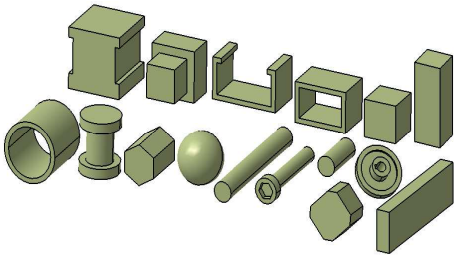

Fig.1: Different types and shapes of parts

Design shape of gripper active element is the first step by the design of jaws shapes. Gripper active element design is made through graphic methods, which accept shapes, dimensions of handling element, necessary kinematics of jaws movement by the grip. These methods must accept touch points at the active parts of gripper's jaws. Main parameters for selection of grip method at the intelligent manufacturing cell:

- ☐ object characteristic of handling: shape, dimensions, weight,
- ☐ object attribute: stiffness, shape, surface condition,
- ☐ places for grip: shape, centre distance, attribute of main places,
- ☐ handling requirements,

Shape design of gripper elements is dependent on shape, blanks dimensions and parts and cooperation with devices. Gripper jaws will be designed in two basic effectuates and will to handle with selected type and blanks form and parts.

## ❖ DESIGNED BASIC EFFECTUATES OF GRIPPER JAWS

☐ ROTARY BLANKS – GRIPPER JAWS will shape of V-block, Advantages of prismatic grip:

- reliable grip,
- centering,
- grip of rotary blank and at gripper jaws,

Jaws V-block is designed in different sizes for different diameters of blanks. These different sizes ensure reliable grip for blanks and parts of diameters.

SIZE CALCULATION JAWS V-BLOCKS for diameters from D=5mm to D=80mm for angle 90°

Jaws V-blocks have different grip angle from 45° to 120°. V-blocks with angle is 90°.

Calculation procedure of jaws V-blocks:

1. Calculation of V-block width V-block width is calculated for maximal and minimal diameter of fixed rotary blank.

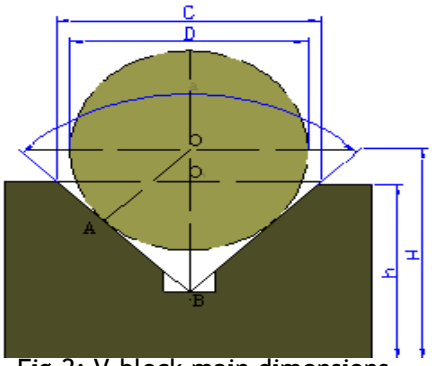


Fig.2: V-block main dimensions A – tangent of blank with V-block, D – diameter of fixed blank, C – width of V-block , h – depth V-block, H –Axis-X distance of blank from base , O – axis of fixed blank, O1 – centre of V-block width V-blocks parameters: angle of opening=*90°*, $D_{min}$=*5mm*

On the fig.2 is V-block main dimensions.

Calculation of V-bloks width for miminal diameter $D_{min}$=5mm fig.3.

$$\overline{OB} - \overline{O_1B} = 0$$

$$\frac{\overline{OA}}{\sin\frac{\alpha}{2}} - \frac{C}{2tg\frac{\alpha}{2}} = 0$$

$$\frac{2,5}{\sin\frac{90}{2}} - \frac{C}{2tg\frac{90}{2}} = 0$$

$$\frac{2,5}{0,707} - \frac{C}{2} = 0 \Rightarrow C = \frac{5}{0,707} = 7,07mm$$

Fig.3: V-block width for blank with minimal diameter $D_{min}$=5mm is 7,07mm

CALCULATION OF FIXED BLANK MAXIMAL DIAMETER, which is fixed in the V-block of with 7,07mm

Calculation is on the "fig.4".

$$\sin\frac{\alpha}{2} = \frac{\overline{OA}}{C} \Rightarrow \overline{OA} = \sin\frac{\alpha}{2} \cdot C = 0,707 \cdot 7,07 = 4,99mm$$

$$D_{max} = 2 \cdot \overline{OA} = 2 \cdot 4,99 = 9,99mm$$

Fig.4: Calculation of maximal diameter

Maximal diameter of blank is 9,99mm. This blank is possible to fix in the V-block.

On the fig.5 are V-block dimensions and diameter of blank.

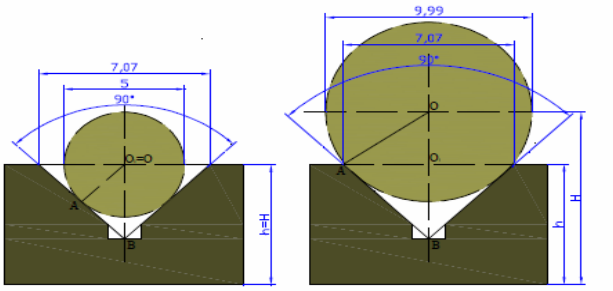


Fig.5: V-block dimensions and diameter of blank. *7,07mm*

☐ NON-ROTARING BLANKS – GRIPPER JAWS will be designed as flat and shaped jaws.

On the "FIG.6" is possible to see designed shapes of gripper jaws.

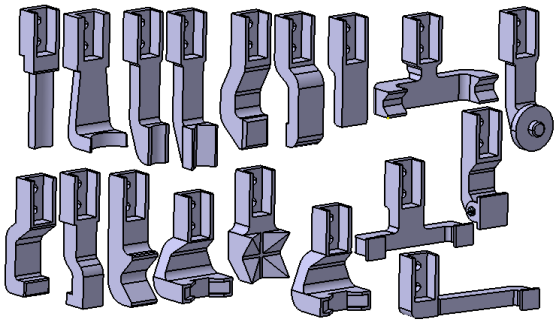

Fig.6: Designed shapes of gripper jaws

## ❖ GRIP ALTERNATIVES THROUGH DESIGNED GRIPPER JAWS

1. LONG PART OF ROTARY SHAPE: SCREW

On this grip of long rotary part – screw "FIG.7". Contact piece of jaws with screw is designed for exact diameter of screw.

This design is appropriate for insertion of screw in holes by assembly.

Main requirements for this grip are:

☐ distance of part,

☐ throw of manipulator at the intelligent manufacturing assembly cell in axis-Z,

2. GRIP OF SPHERICAL BLANK

Designed jaws ensure grip and centering of blanks "FIG.8".

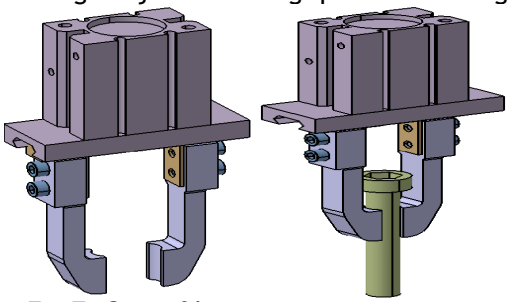

Fig.7: Grip of long rotary part – screw

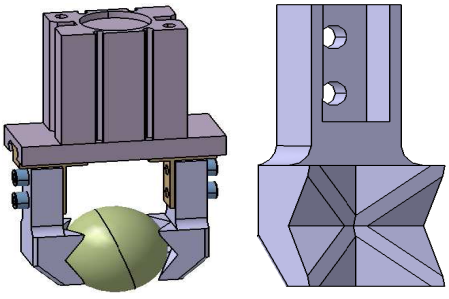

Fig.8: Grip for spherical blank

## ❖ CONCLUSIONS

During the design process of intelligent manufacturing cell, and during the design process of automated tool changing system, jaws types design a sequential diagram methodology was used. In the intelligent manufacturing-assembly cell are situated some shape of gripper with different shapes of jaws for blanks handling or tools handling.

Gripper with jaws is situated at the workplace intelligent manufacturing cell in buffers. Buffers fixed at the work panel through screw.

## ❖ ACKNOWLEDGMENT

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## ❖ REFERENCES

[1.] DANIŠOVÁ, N.: Application of intelligent manufacturing system in the flexible assembly cell In: Annals of Faculty of Engineering Hunedoara - Journal of Engineering, (2007), pp. 41-45.

[2.] MATUŠOVÁ, M. HRUŠKOVÁ, E.: Methods of fixture design. In: Automation and CA Systems in Technology Planning and Manufacturings. Poznaň . (2007), pp 155-158

[3.] STUJA, K.2007.: Considerations on the Jara Open Robot Interface for the Network Architecture.In: DAAAM International Scientific Book, Viena Austria, (2008), pp.659-666

[4.] MUDRIKOVÁ, A. KOŠŤÁL, P. MATUŠOVÁ, M.: Building of a production system program control laboratory. In: Annals of DAAAM and Proceedings of DAAAM Symposium. - ISSN 1726-9679. - Vol. 20, No. 1 Annals of DAAAM for 2009 & Proceedings of the 20th international DAAAM symposium "Intelligent manufacturing & automation: Focus on theory, practice and education" 25 - 28th November 2009, Vienna, Austria. - Vienna : DAAAM International Vienna, 2009. - ISBN 978-3-901509-70-4, s. 0603-0604

[5.] HOLUBEK, RADOVAN - VLÁŠEK, MATÚŠ - KOŠŤÁL, PETER: Clamping jaws with sensory equipment for intelligent fixture. In: Annals of DAAAM and Proceedings of DAAAM Symposium. - ISSN 1726-9679. - Vol. 21, No 1. Annals of DAAAM for 2010 & Proceedings of the 21st International DAAAM Symposium "Intelligent Manufacturing & Automation: Focus on Interdisciplinary Solutions" 20-23rd October 2010, Zadar, Croatia, - Vienna : DAAAM International Vienna, 2010. - ISBN 978-3-901509-73-5, s. 1173-1174

[6.] J. NOVÁKOVÁ., L. PETRKOVSKÁ., J. BRYCHTA, D. STANČEKOVÁ. 2009. "Influence of Cutting Parameters on Integrity Surface at High Speed Cuttin". Transactions of the VŠB - Technical University of Ostrava. Mechanical Series, 2009, ročník LV., číslo 1/2009, Česká republika. Ostrava: VŠB – TUO, 2009, s. 203 – 209. ISBN 978-80-248-2051-4. 370

[7.] MAJERIK, J. & BAJCIK, S. (2008). CAD/CAM systems aid by computer. Strojárstvo, Vol. 12, No. 11, 2008, p. 108 – 109, ISSN 1335-2938

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