13th International Research/Expert Conference
"Trends in the Development of Machinery and Associated Technology"
TMT 2009, Hammamet, Tunisia, 16-21 October 2009

MECHANICAL ENGINEERING ELEMENTS. THEORY AND APPLICATION

Ph. D. Eng. Gabriel Vladu, Ph. D. Eng. Catalin Eugen Ionescu,
Ph. D. Eng. Georgica Slamnoiu, Ph. D. Eng. Adrian Ciuculin
Naval Forces Scientific Research Centre
Constanta City, Romania

Eng. Florin Suciu, Eng. Alin Sava
Military Technical Academy
Bucharest City, Romania

ABSTRACT
The global function of grasping mechanism is to integrate the manipulate object in the robotic mechanical system. The orientation object inside of the grasping mechanism implies contact between the characteristic points of the object and other characteristic point of the jaw elements mechanism. Those characteristics points are parts of the grasping object surfaces, named orientation surfaces, which can be grasping points. Theoretical, the maximum number, enough and necessary of those characteristic contact points must be six, sited in differed three planes, perpendiculars, in concordance with the six points rule, and in this case all the grasping surface objects, respectively characteristics points and lines occupied determinates uniform positions, this grasping named complete. If the number of characteristic contact points is less of six the grasping named incomplete. Actually, contact between the object and jaw made on surfaces and points, particularly in points (contact sphere – plan), important is that the characteristics contact points will be a part of those geometric elements. Ordinarily, in hazardous environment the shape of the object are cylindrically or parallelepipeds. Important is that characteristic point and characteristic line of the grasping objects will be inside of the grasping mechanism, else we have specific grasping error.
Keyword: robot, parallel jaws, multifunctional jaws

1. OPTIMUM DESIGN
The design analyze suppose an optimized through the dimension of the element must be realized a safety grasping and ensured a proper grasping force. Generally, the motion jaws could be rotary or translation motion, but the optimum motion of the jaws is the plane roto-translation, which assure minimum alignment errors.
Therefore, the structure of the grasping device need to be adapt for the shape and the dimension of the object that will be manipulate [2], such as the jaw-object contact to be enough for ensure a safety grasp.
In fact, a disadvantage of the gripper device with rotary motion of the jaw is practically these have alignment errors.
When gripping parallelepiped object with jaws rotary or translation motion (figure 1 a, b), the safety grasping is assurance by the device who have jaws parallel position with the surface object. This position is obtained with the jaws with translation motion (figure 1 b), in this case we need to know the position of the manipulated object. If the distance *x* grow up the safety grasping send down.

When gripping cylindrically object, the contact between jaws and object represent a contact line. We observed that the jaws-object contacts are two linear contacts, and in this case the object can round between the jaws.

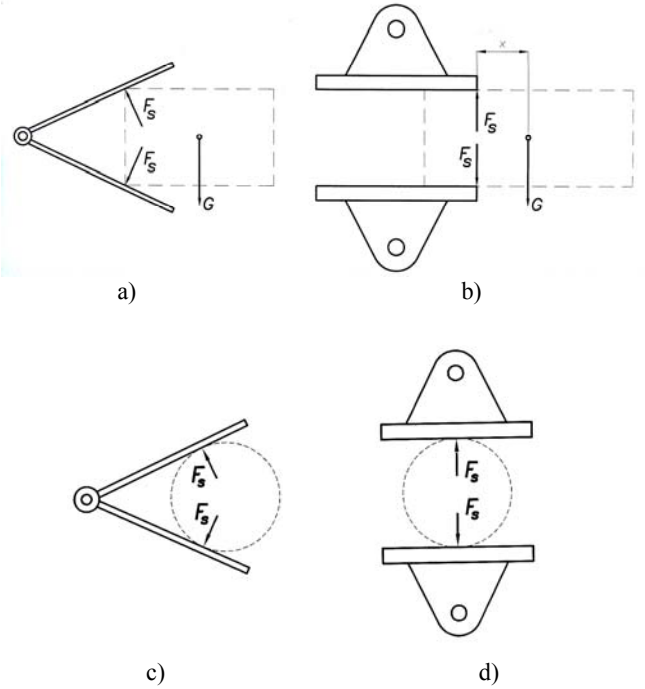


Figure 1. Grasping the object with two parallel jaws
a, b - parallelepiped objects;c, d - cylindrically objects.

An original solution for the jaws is represented in figure 2, this solution can grasp in safety condition parallelepiped object and cylindrically object, in the same time without change the jaws of the gripper device.

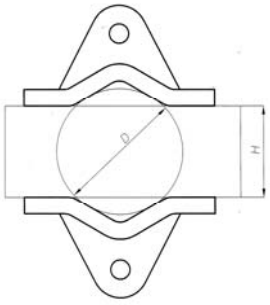
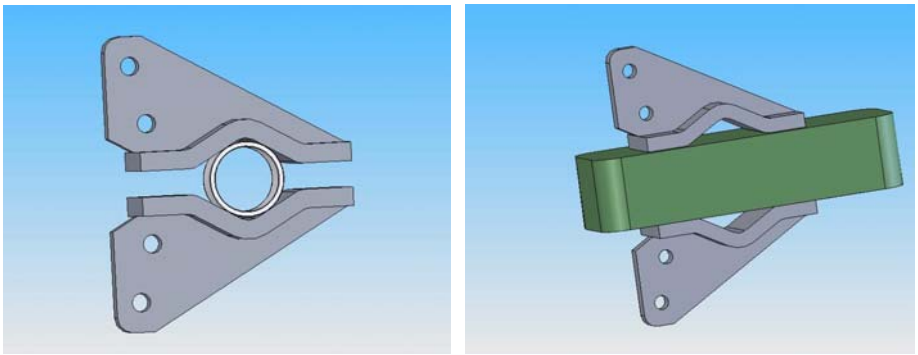


Figure 2. Multifunctional jaws

For the geometric and cinematic analyze we use SolidWorks and CosmosWorks program, in this way was optimized the jaws to grasp cylindrical and parallelepiped objects, this is shown in the figure 3.



a) b)

Figure 3. Grasping the cylindrical (a) and parallelepiped (b) object

After geometric optimized with this jaws a robotic griper can grasp safety cylindrical object with Φ 17mm and plane object with 0.1 mm thickness. In figure 4 are shown the prototypes of these jaws.

Figure 4. The prototypes of multifunctional jaws

A robot gripper (figure 5) which uses multifunctional jaws is designed for gripping cylindrical and parallelepiped object.

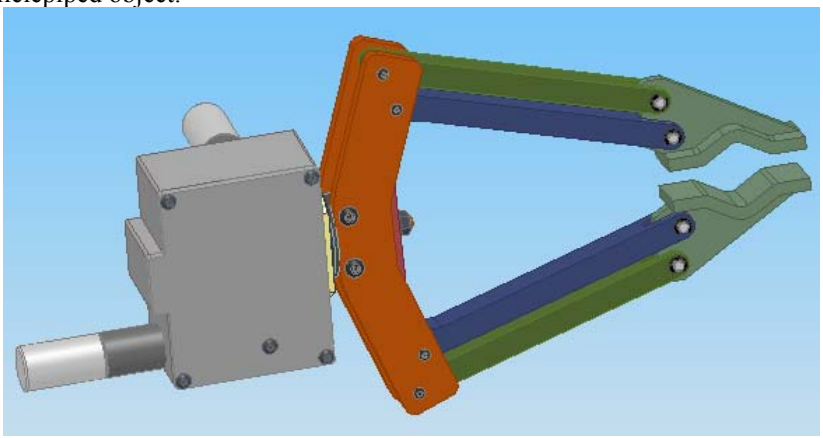


Figure 5. Parallel robot gripper with multifunctional jaws

2. CONCLUSION

To ensure a safety grasp, the structure of the robotic gripper needs to be adapted at the dimension and the shape of the object.

In this paper was presented an original concept for multifunctional jaws who can grasp cylindrically and parallelepipeds object.

3. REFERENCES

[1] Cârlugea, M., Elemente de analiză pentru implementarea dispozitivelor de prehensiune în zone de risc, Bucureşti, 2006;

[2] Cârlugea, M., Elemente de sinteză. Evaluarea parametrilor funcționali. Optimizarea dispozitivului de apucare prin reconfigurarea componentelor, Bucureşti, 2006.