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THE KINEMATICS' ANALYSE OF AN ECCENTRIC MECHANISM OF A MOWER MACHINE

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Abstract: The paper is structured in two parts. In the first part is described the construction of the cut-off mechanical system from one mowing machine and achieved the kinematics modelling for the actuator mechanism. The kinematic analyse is achieved with the visualNatran software program. The second part of the paper refer to the mechanism kinematics analyse. They are presented diagrams with the positions, speed and acceleration of the mechanism elements.

1. INTRODUCTION

The cut-off systems used to mowers, accomplishes the cutting of the plants (the separation of plants parts), trough detrusion, the cut-off organ (the knife) acting on the plant with the speed of 1-2,5 m/s. In the time of cut the plant is maintained by a versus cut part, of usually fixed.

2. DESIGN OF CUT-OFF SYSTEMS

Most prevalent cut-off systems used to mowers are one whereat the knife has reciprocation, with versus part fixed (systems with classic construction). Constructive these systems are composed from a mobile part and an actuating mechanism.

The fixed part of the cut-off system (fig. 1) is represented by a fixed support element on which are mounted, at determinate length between them, the fingers.

Each finger is composed by a body (fig. 1, d) in which is mounted versus cut part (fig. 1, c), with the edges sharpen below an angles of 45-60°, foresee with cogs orientate towards backward, what assures a good maintain of the plants in the time of cut. To some mowers, the fingers are not foresee with versus cut plates, these role being carried out by the edges oneself of the finger body.

The mobile part of the cut-off system is represented by the knife, proper composed by the bar (rail of the knife) on which are mounted the cut-off blades.

The cut-off blades have the shape showed in the figure 1, b, the cutting edges being sharpen below an angle i = 19-23°. The cutting edges of the blades can be smooth or toothed; the tooth can't be realized on the superior part, or the inferior part. The main dimensions of the cut blade, are presented in the figure 1, b.

The knife is mounted in the space between the fingers body and their superior part, being guided in the time of the work by the guide plates and the anterior part of the support bar (or the friction plates, fig. 1, a). The guide plates (as well as the friction plates) are mounted on the support bar of the finger to certain distances (to each 4-5 fingers).

For the cut-of systems actuation are used mechanisms with crank rod or mechanisms with oscillatory washer. These mechanisms transform the rotation movement of the actuation shaft in alternative translational movement of the knife.

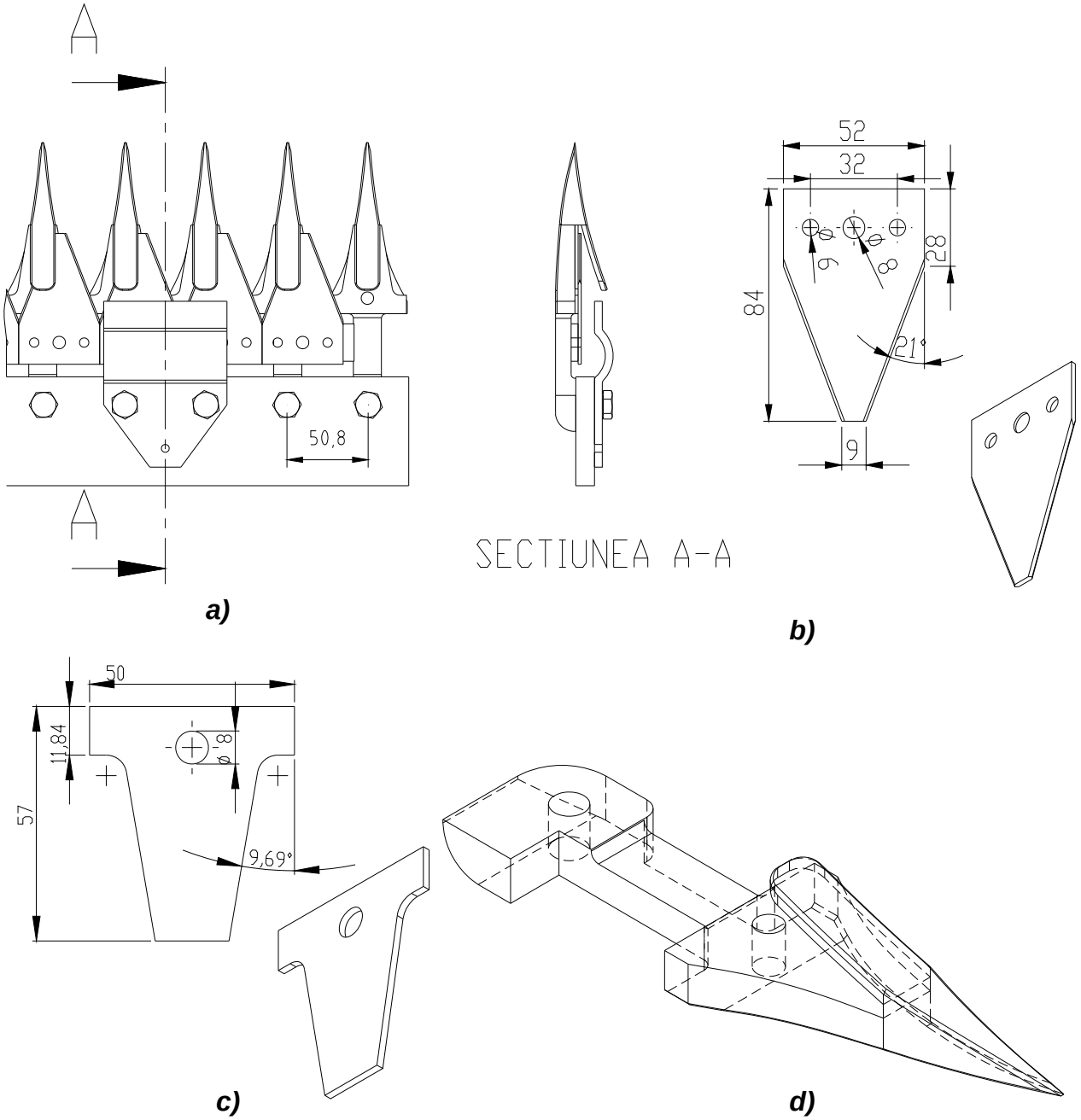


Fig.1.The component part of the cut-of system

In figure 2 are shown differently schemes of actuator mechanism with rod (fig. 2, a, b and c) and with oscillatory washer (fig. 2, d).

In the case of mechanisms with rod, the connection between the rod and the knife can be achieved directly (figure 2, a), or by intermediary elements (balance lever, rods).

To the mechanism with oscillatory washer, the actuation shaft 1 is equipped with a bent portion 2. On the portion 2 is mounted an oscillatory washer 3. By means of two diametrical opposite plugs, on oscillatory washer is mounted the pitchfork 4 what does common body with the oscillatory shaft 5. Imprinting the motion of rotation to the shaft 1, the washer, pitchfork and the axle 5 get a motion of oscillation what is transmitted to the knife by means of the rod 6.

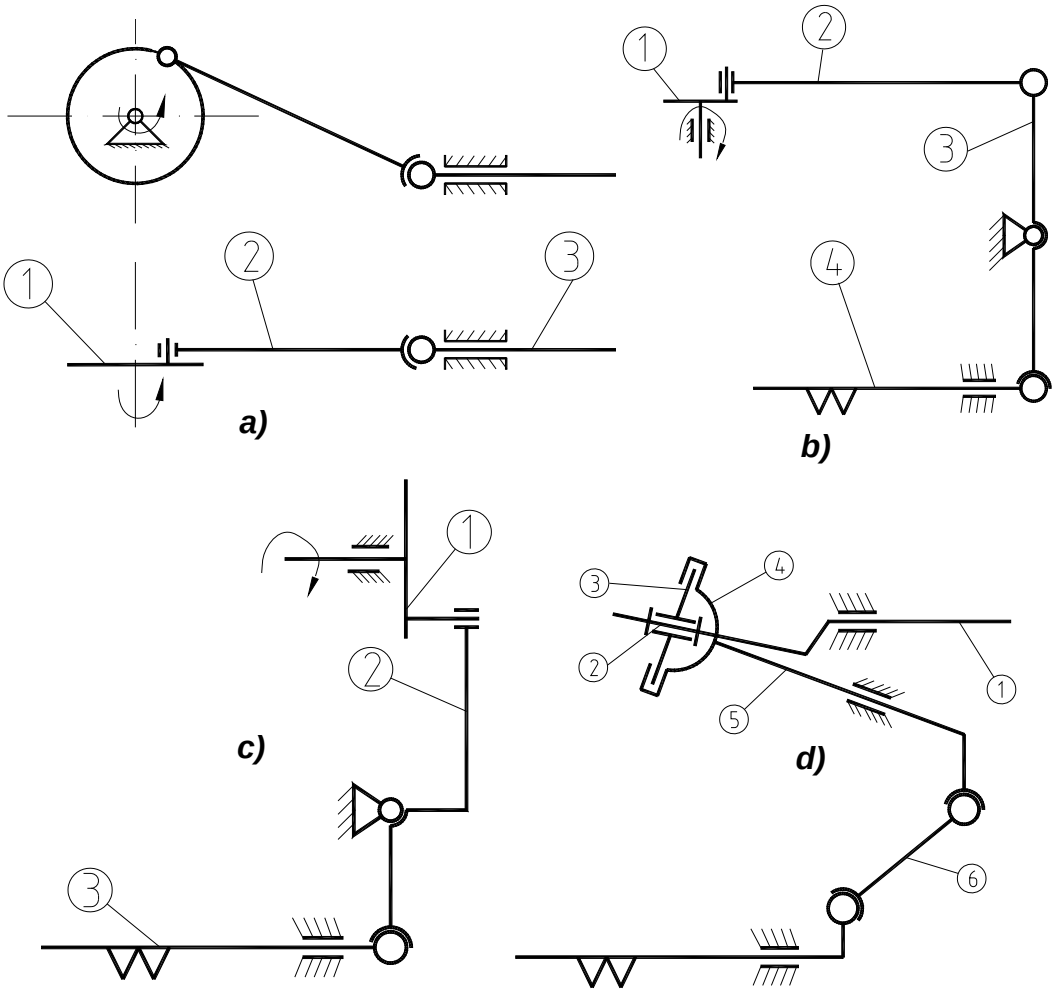
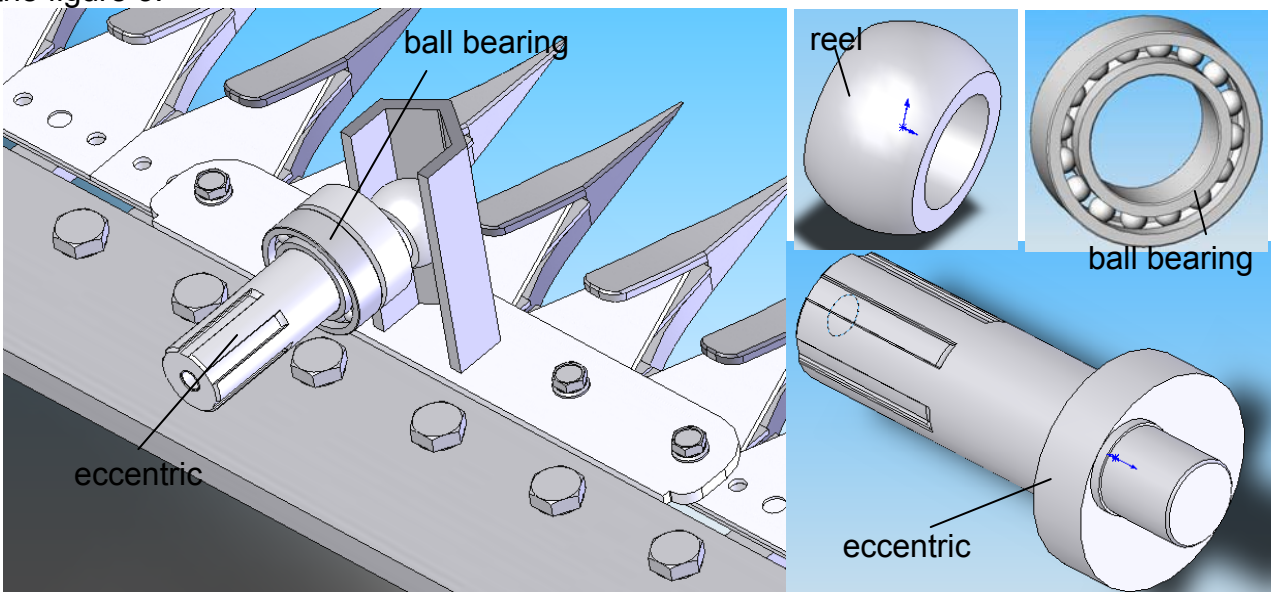


Fig.2.Schemes of mechanism for the knife actuation

The 3D model of the mechanism used for the mower knife actuation is presented in the figure 3.



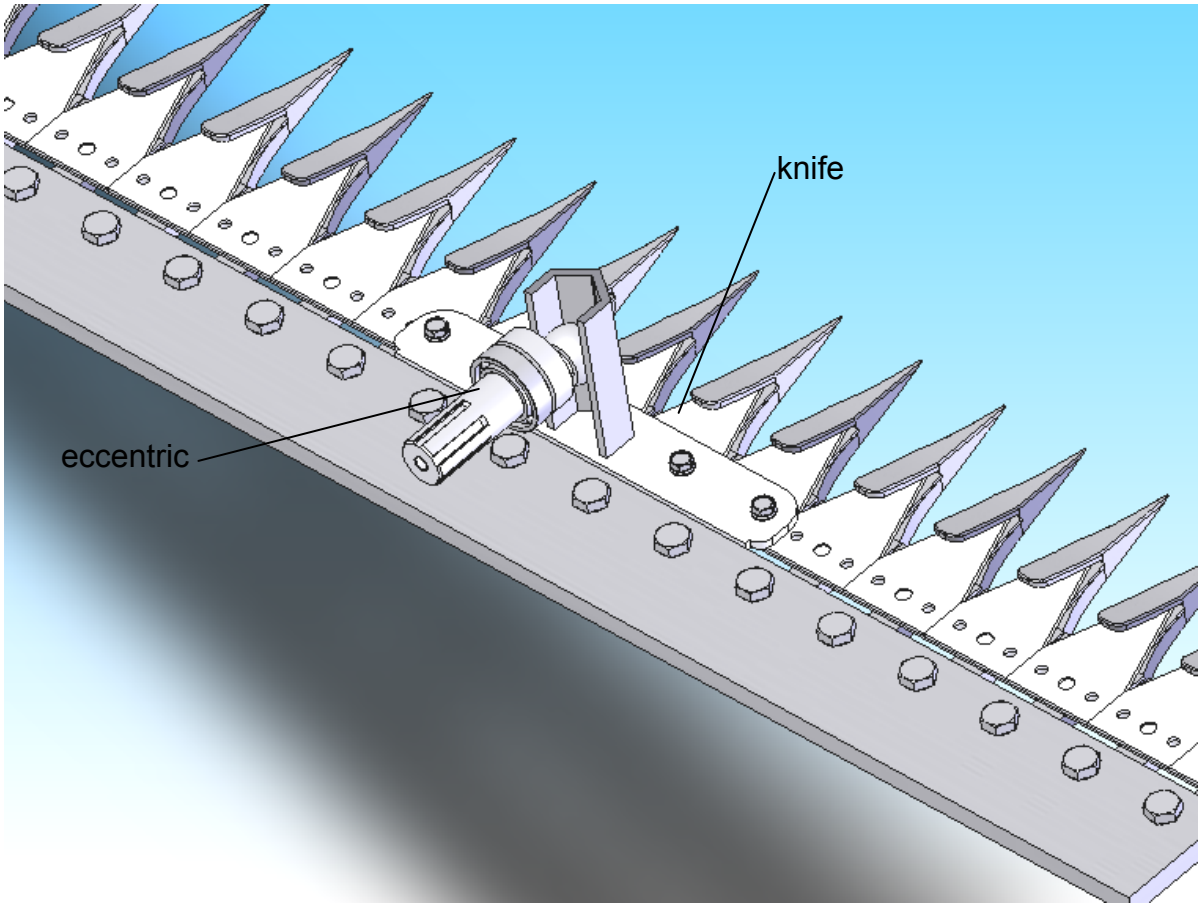


Fig. 3.The 3D model of the mechanism achieved in Solid Works

3. KINEMATICS' ANALYZE

The mechanism has an actuator element which is the eccentric. The kinematical analysis of the mechanism has been realized with the help of VisualNastran program. In figure 4 is showed the defining of the kinematics model in VisualNastran.

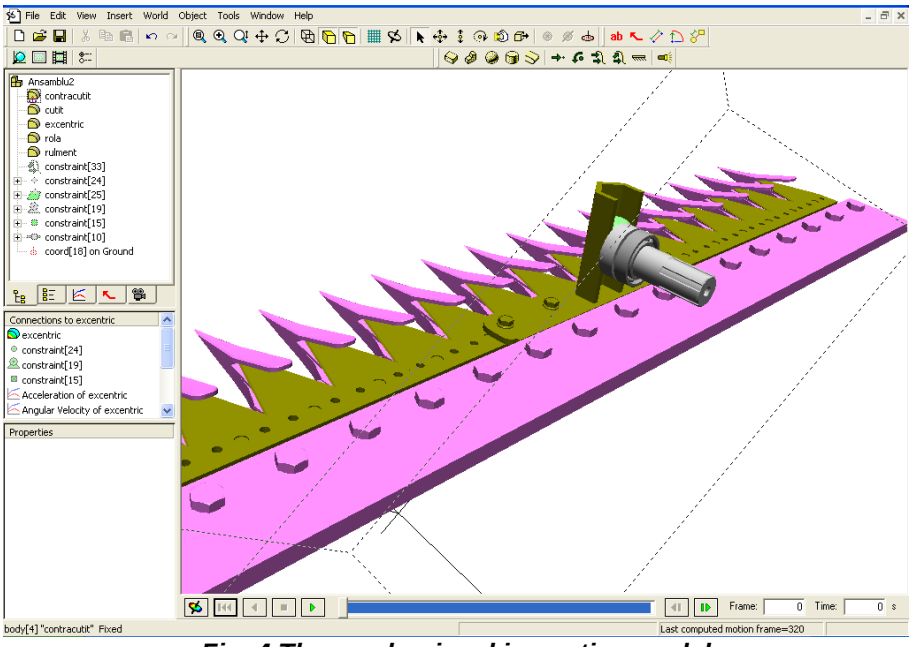


Fig. 4.The mechanism kinematics model

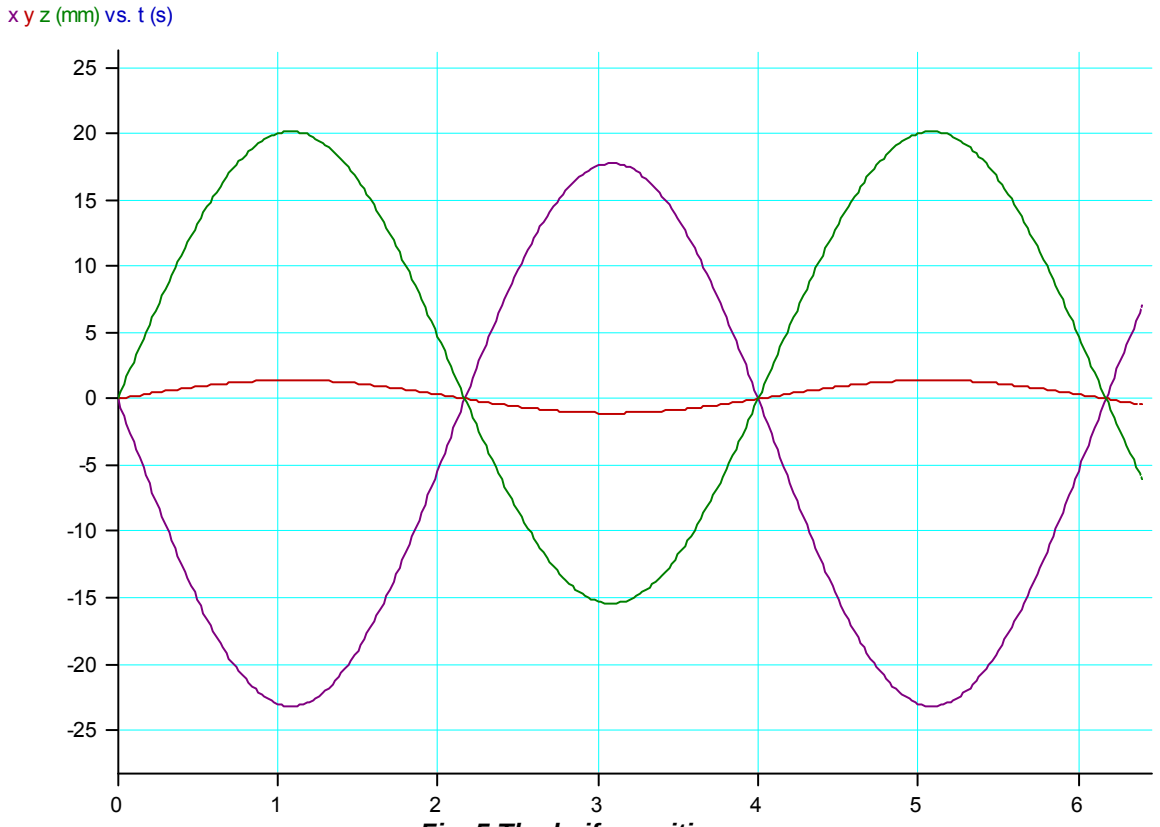


Fig. 5.The knife positions

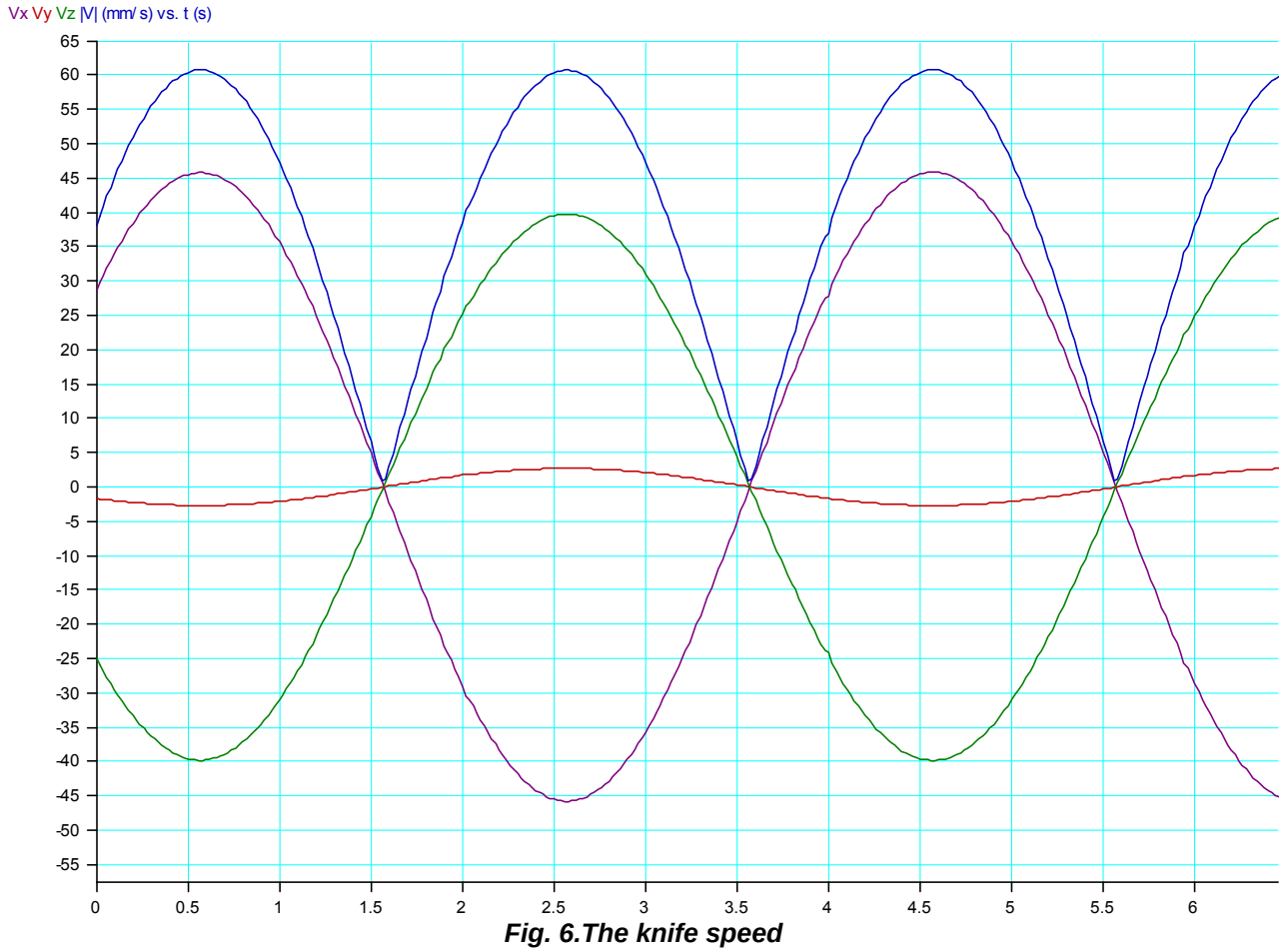


Fig. 6.The knife speed

In figures 5, 6 and 7 are presented the knife positions, speed and acceleration.

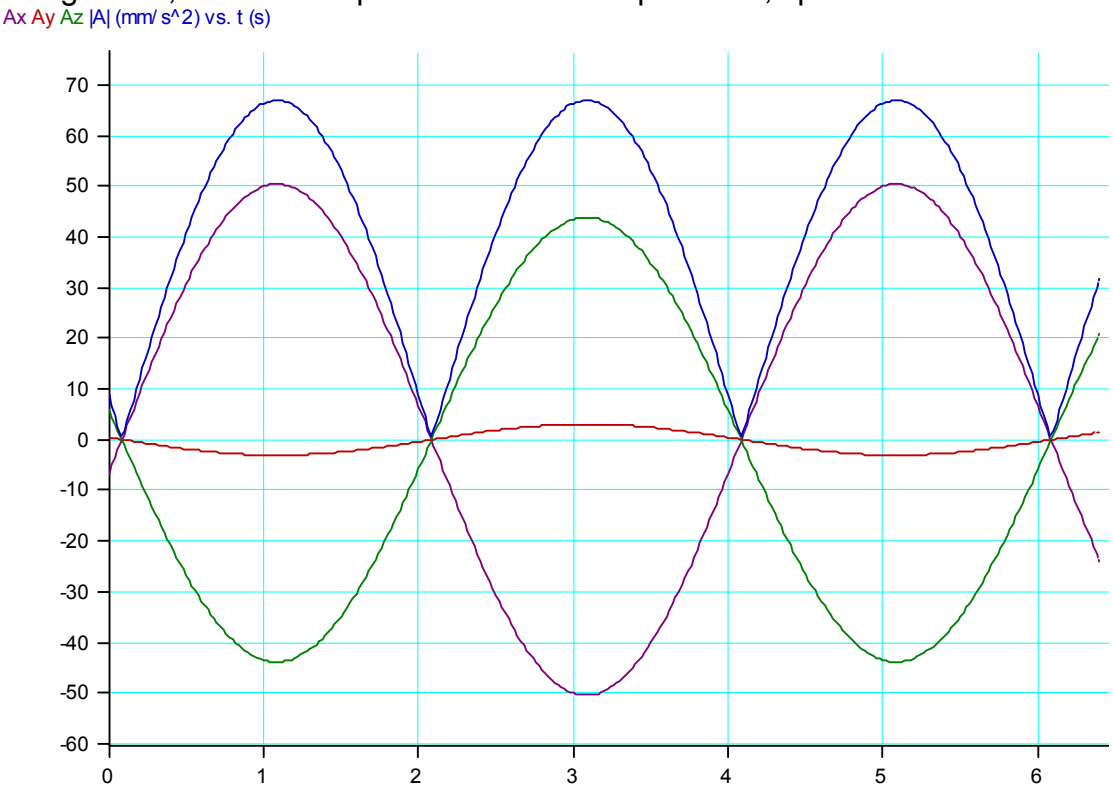


Fig. 7.The knife acceleration

In figure 8 in presented the variation of the linear momentum which acts upon the knife.

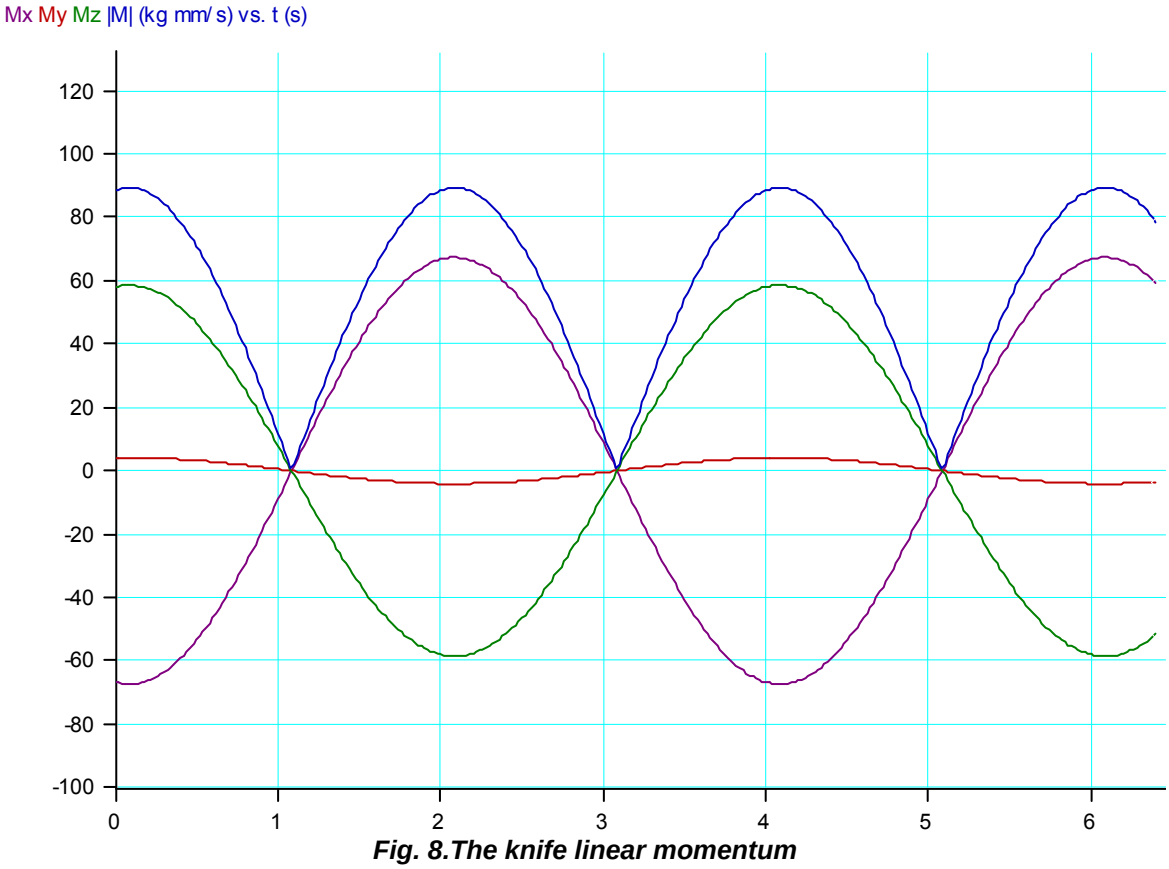


Fig. 8.The knife linear momentum

In figures 9, 10 and 11 is presented the eccentric variations law for the positions, speed and acceleration.

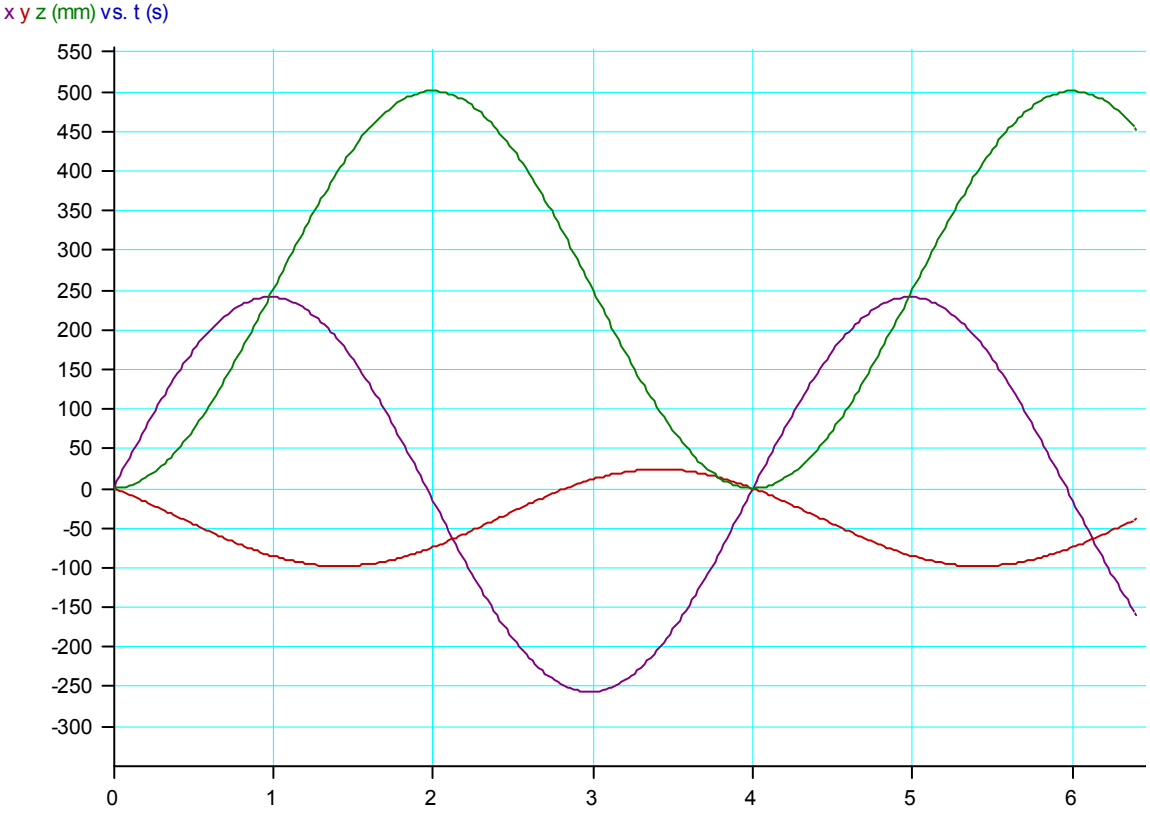


Fig.9.The eccentric position

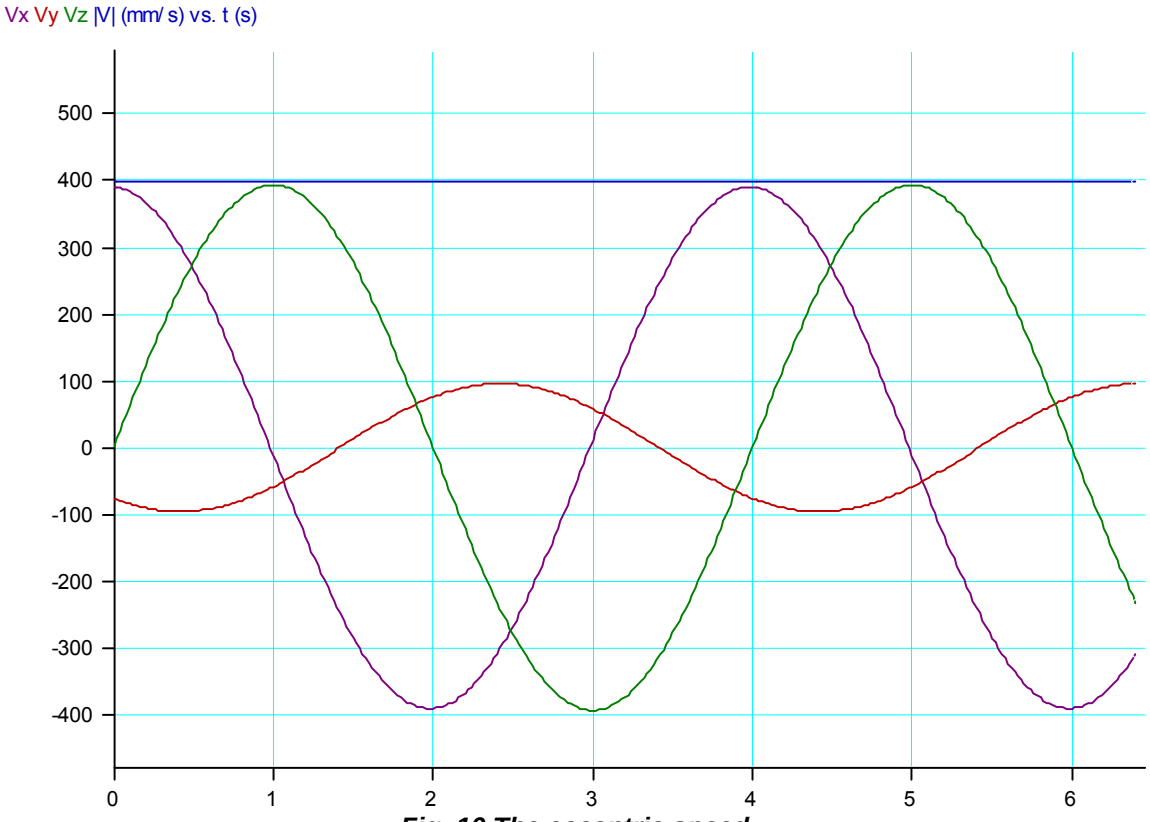


Fig. 10.The eccentric speed

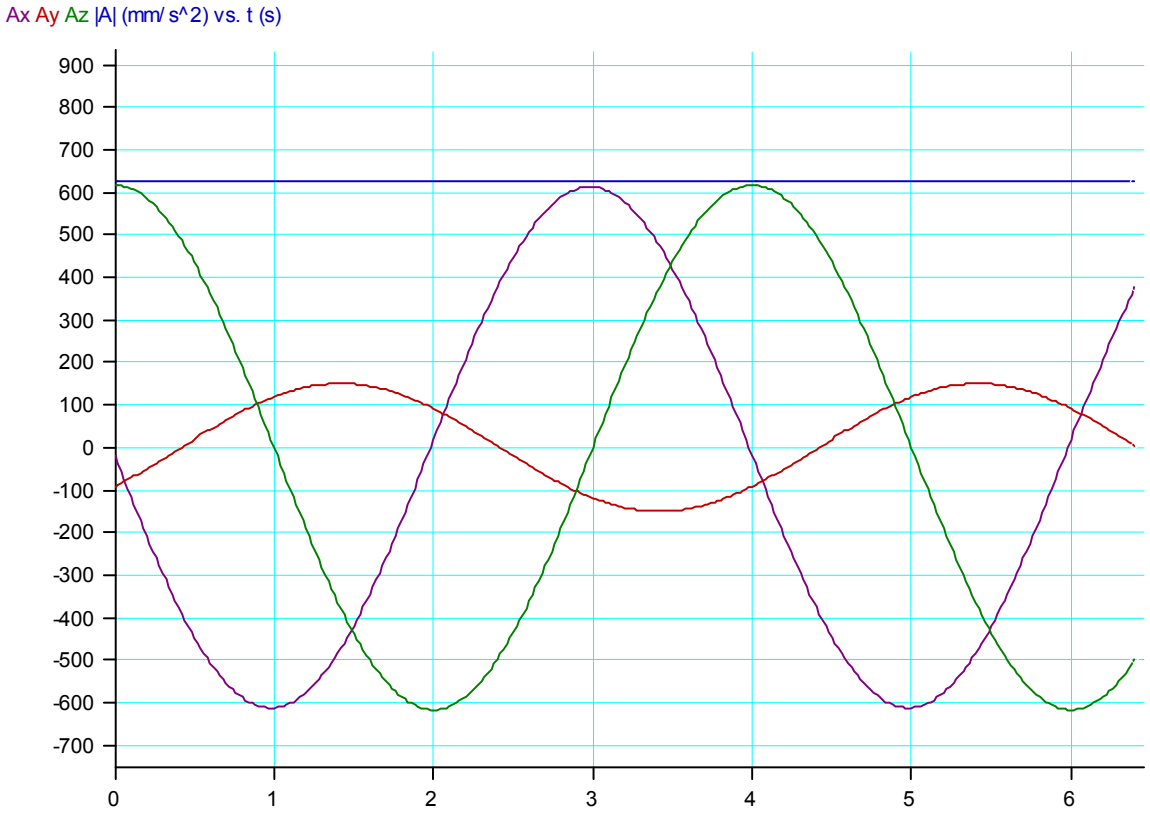


Fig. 11. The eccentric acceleration

4. CONCLUSIONS

The VisualNastran software can be used for the kinematics and dynamic analyses of the mechanism.

The revolution speed of the actuator element of the cutting mechanism is necessary to be correlated with the machine displacement, in order to realize an optimum cutting diagram.

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