Analele Universităţii de Vest din Timişoara
Vol. LI, 2007
Seria Fizică

MOTION SIMULATION OF A VIBRATING DEVICE OF CRANK AND CONNECTING-ROD TYPE

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Abstract
In the paper it is studied the kinematics of a crank and connecting-rod mechanism, making a parallel between the theoretical results and the computer simulation, using the CosmosMOTION included in SolidWORKS software. With this aim, there were traced the diagrams of cinematic parameters of mechanism motion, i.e. the displacement, velocity and acceleration of slide block, as functions of time.
Keywords: cinematic parameter, crank and connecting-rod mechanism, computer simulation.

1. Introduction.

The device of crank and connecting-rod type is considered with the structure in figure 1. It consists of a disk, driven by a motor with different angular velocities (rotation frequencies). The axel *O* of the disk represents also the axel of the crank *OA*, so that the crank rotates together with the disk. The connecting-rod *AB,* articulated in *A,* assures the rectilinear translation motion of the beam *BC*.

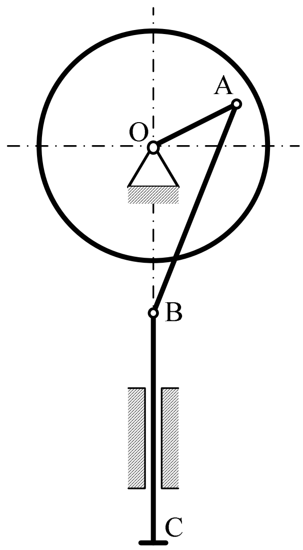


Fig.1. Kinematic model

2. Theoretical Considerations

As it is known, the beam *BC* executes an oscillatory rectilinear translation motion with the amplitude equal to the length *OA* of the crank. In the Classical Mechanics a kinematic study of a motion means a pure geometrical study of motion, without taking into consideration any dynamic element as the mass and forces. In the performed simulation, to respect as possible the reality, it was introduced the effect of mass magnitude of mechanism components. So, the kinematic-dynamic values of parameters are as follows:

- Disk mass: $M = 24.31\,g$;

- Total mass of elements *OA, OB, OC: m*= 58.53 *g*;
- Length of the crank *OA*: *e*=25 *mm*.
- Length of the connecting road *OB*=85 *mm*

3. Experimental Simulation

In figure 2 it is presented the aspect of the simulated system where can be recognized the component elements in figure 1, and in figure 3, the corresponding theoretical model.

The aim of simulation was the obtaining of the kinematic parameters (displacement, velocity, acceleration) for the point C. The simulations were performed corresponding to different values of the angular velocity.

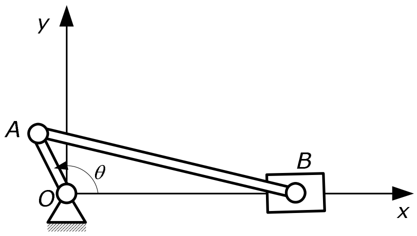


Fig.3. Theoretical model

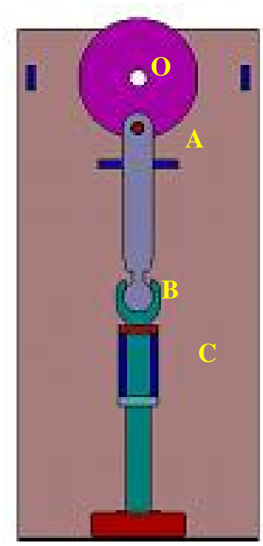
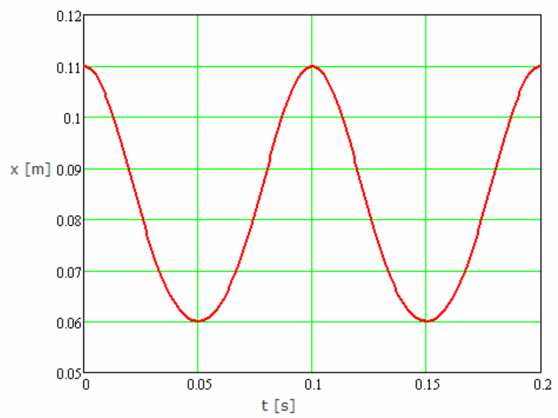
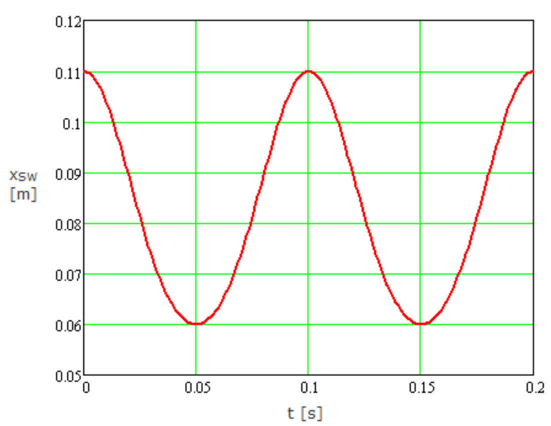


Fig.2. Mechanical model

As result of the simulations, there were obtained the following diagrams, corresponding to the working direction of the mechanism, i.e. along the vertical axis (*Oz*):

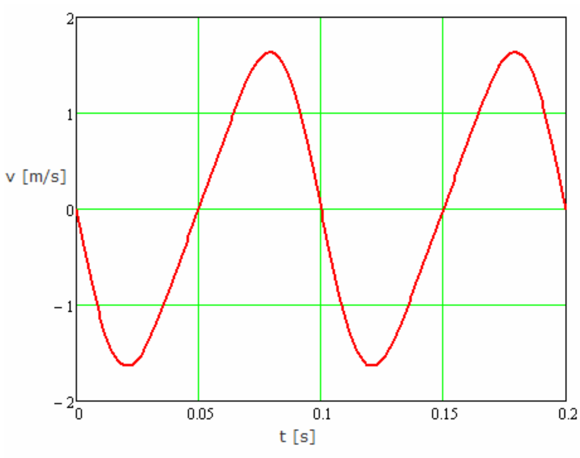


a. Theoretical

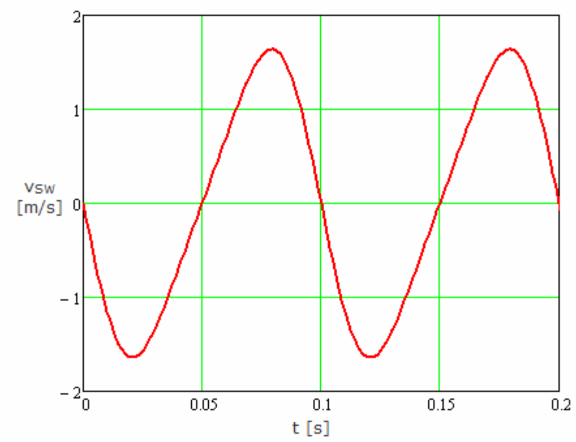


b. Simulated

Fig.4. Displacemet at 10 Hz rotation frequency

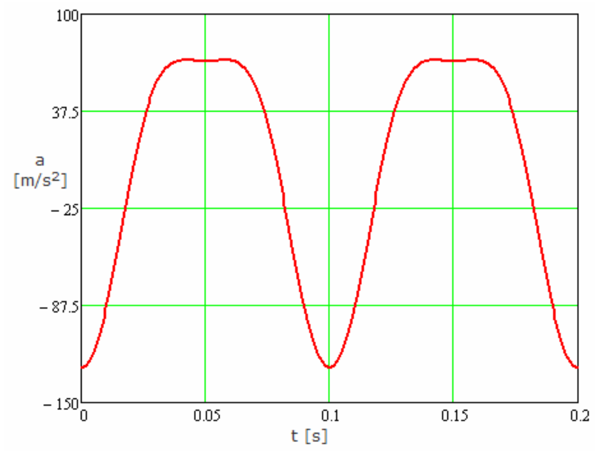


a. Theoretical

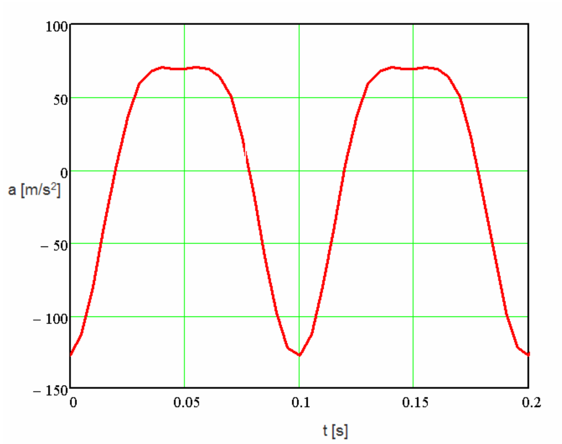


b. Simulated

Fig.5. Velocity diagram at 10 *Hz* rotation frequency



a. Theoretical



b. Simulated

Fig.6. Acceleration diagram at 10 *Hz* rotation frequency

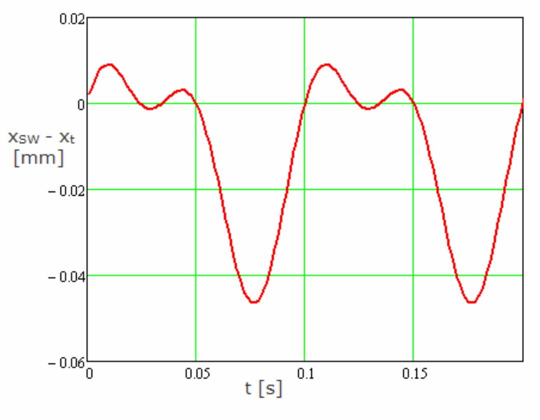


Fig.7. Displacement difference between simulated and theoretical results

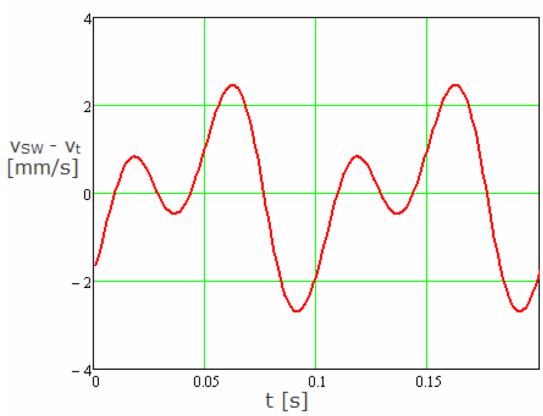


Fig.8. Velocity difference between simulated and theoretical results

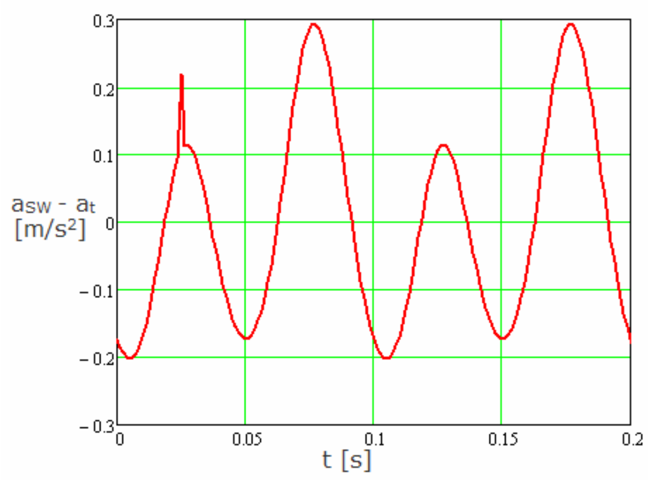


Fig.9. Acceleration difference between simulated and theoretical results

4. Conclusions

As conclusions it is remarkable the fact that the performed simulation appears as a high accuracy one, because it emphasizes the parasite displacements, velocities and accelerations on perpendicular directions (*Oy* and *Oz*). So, the parasite displacement are, respectively, $y=3.00635\cdot10^{-9}\,mm$, $z=2.37392\cdot10^{-11}\,mm$, for the last moment of simulation, appeared due to the joint plays.

The explanation of thee displacement differences is, as it was mentioned, the considering of masses of elements which generated the apparition of inertia forces.

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