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On the Cinematic Analysis of a Mechanism of Fourth Class

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Abstract

In the paper some results concerning the cinematic analysis of a mechanism of fourth class are presented. The structure of the mechanism is modeled using the Inventor software. Also, Inventor software is used for realizing the cinematic analysis of the mechanism. Some interesting simulation results regarding the trajectories of some important points on the mechanism and the speed and acceleration variation of these points are presented.

Key words: *mechanism of fourth class, trajectory, kinematics*

Introduction

Today the design of the mechanisms which are parts of different devices and machines is often realized using performance computer programs such as: Inventor, Catia, SolidWorks, Solid Edge etc. Using these computer programs virtual prototypes of the mechanisms are realized. Also, a rigorous analysis of the running behavior of the mechanisms is obtained. So, the variations curves of different positional, cinematic or dynamical parameters are established.

In this paper a mechanism of fourth class is cinematically analyzed using Inventor software. Some interesting simulation results regarding the trajectories of some important points on the mechanism and the variation of the speed and acceleration of these points are presented.

Theoretical Considerations and Simulation Results

In figure 1 the cinematic scheme of a mechanism of fourth class is presented. The tetrad *2-3-4-5* is part of the mechanism.

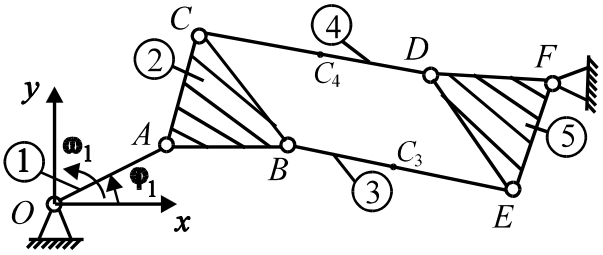

Fig. 1. Mechanism of fourth class

The following elements are considered to be known: $OA = 0.05\,\text{m}$; $AB = AC = BC = 0.068\,\text{m}$; $CD = 0.22\,\text{m}$; $BE = 0.22\,\text{m}$; $DE = EF = DF = 0.068\,\text{m}$; $x_F = 0.27\,\text{m}$; $y_F = 0.021\,\text{m}$.

The points C_3 and C_4 are at the middle of the corresponding links. The angular speed of the motor link *1* is: $\omega_1 = 2\pi$ rad/s.

The component links of the mechanism have been designed using Inventor software. The mechanism is presented in figure 2. The *Dynamic Simulation* module which is part of Inventor has been used for analyzing the mechanism. Using this module the cinematic analysis of the mechanism has been realized.

In figure 2 the trajectories of the points C_3 and C_4 (fig. 1) for a cinematic cycle are presented.

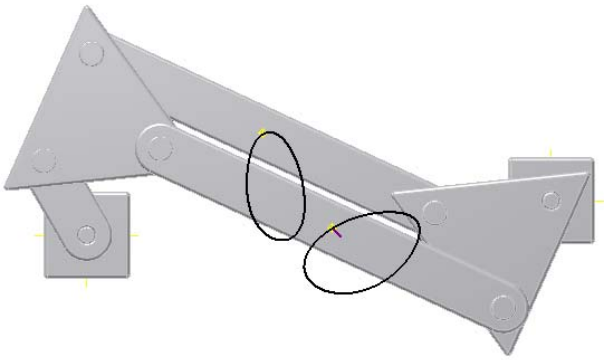

Fig. 2. The trajectories of two points

The two trajectories referenced with the system of coordinates *Oxy* (fig. 1) are presented in figures 3 and 4.

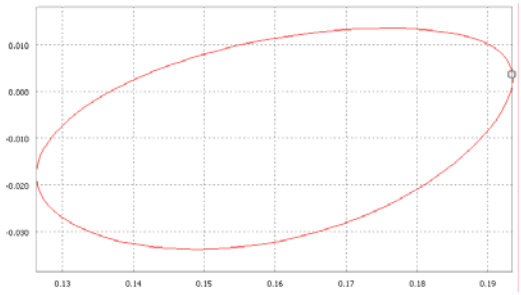

Fig. 3. The trajectory of the point C_3

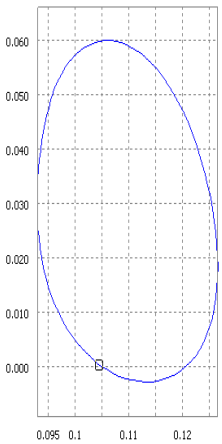

Fig. 4. The trajectory of the point C_4

In figures 5 and 6 the variations of the speed and acceleration of the point C_3 for a cinematic cycle are presented.

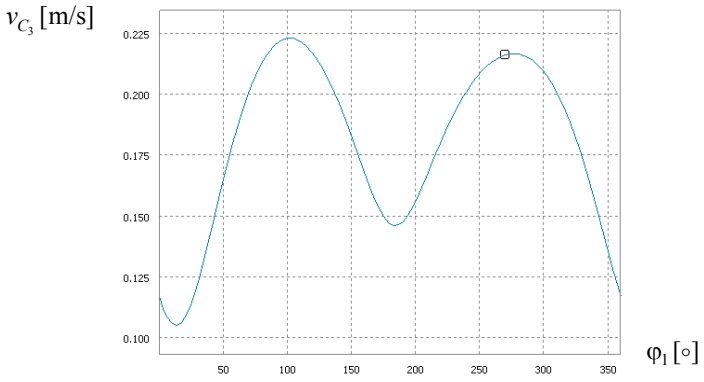

Fig. 5. The variation of the speed of the point C_3

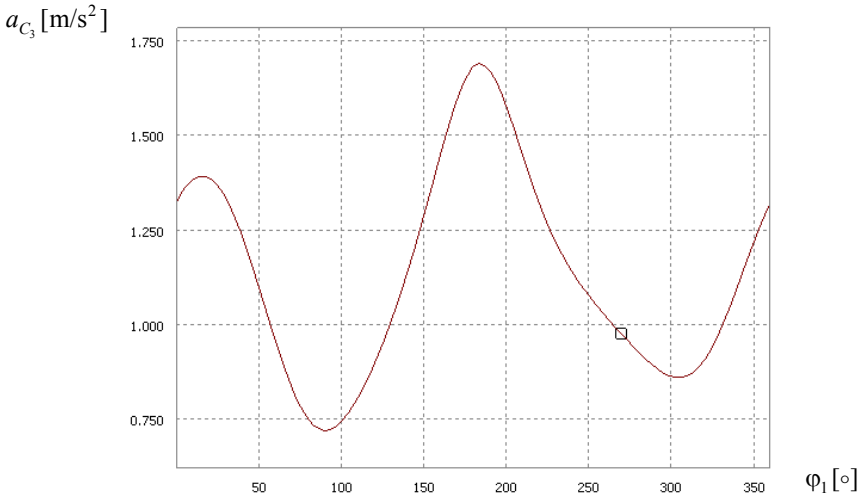

Fig. 6. The variation of the acceleration of the point C_3

In figures 7 and 8 the variations of the speed and acceleration of the point C_4 for a cinematic cycle are presented.

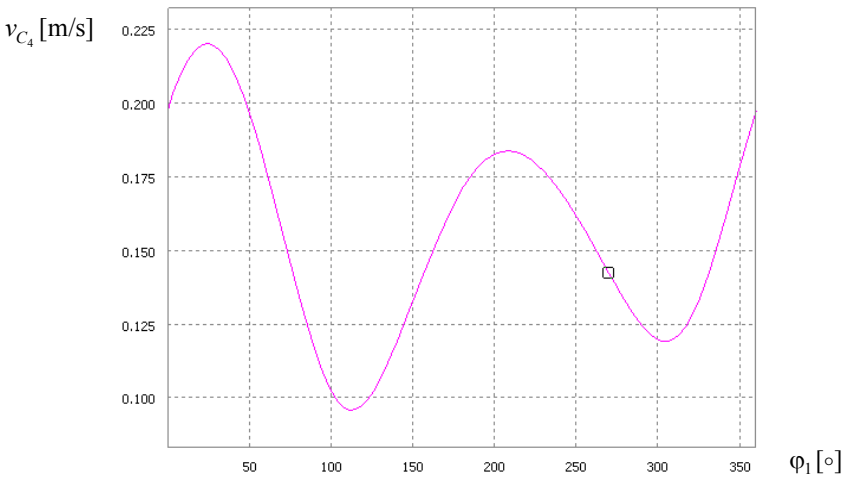

Fig. 7. The variation of the speed of the point C_4

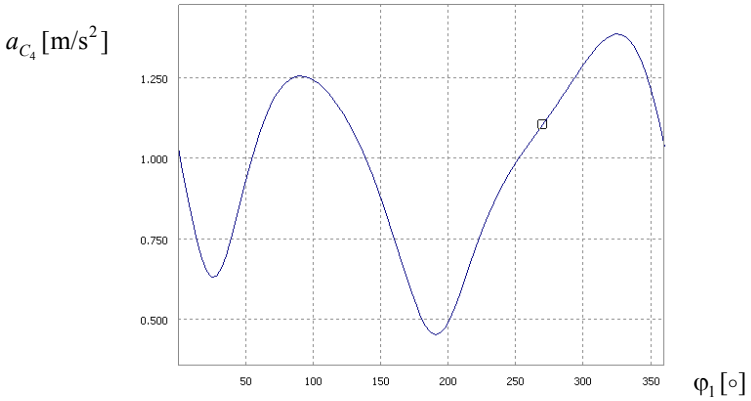

Fig. 8. The variation of the acceleration of the point C_4

Conclusions

In this paper some results concerning the kinematics of a mechanism of fourth class are presented. The analysis has been realized using Inventor software. Some interesting simulation results regarding the trajectories of some important points on the mechanism and the variation of the speed and acceleration of these points are presented.

References

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Asupra analizei cinematice a unui mecanism de clasa a patra

Rezumat

În articol sunt prezentate o serie de rezultate privind analiza cinematică a unui mecanism de clasa a patra. Structura mecanismului este modelată folosind softul Inventor. De asemenea, Inventorul este folosit pentru realizarea analizei cinematice a mecanismului. Sunt prezentate câteva rezultate interesante privind traiectoriile unor puncte importante de pe mecanism si variaţia vitezei şi acceleraţiei acestor puncte.