Analysis and Research of Kinematics and Kinetics of Quick-Return Mechanism Prototype

Chao Zhang
Department of Mechanical Engineering, Shanghai University of Engineering Science, Shanghai, China,

ABSTRACT
In this paper, Based on the rotation of the guide-bar mechanism and slider-crank mechanism of complex research institutions, the first prototype was modeled, and then the displacement, velocity and acceleration kinematics of original moving part, and the output member link were analysized, finally, the kinetic analysis of the main component was studied. Final results of each part of the structure parameters of the prototype integrated performance impact were concluded.

Keywords
kinematics; kinetics ;mechanism .

1. INTRODUCTION
ADAMS software is the world's most authoritative and widely used mechanical system dynamics simulation software. Engineers, designers can take advantage of ADAMAS software to build and test prototype, to implemente analysis of kinematic and dynamic performance simulation of complex mechanical systems on a computer.

According to the mechanical system model , the software of ADAMS automatically establishes the system of Lagrange equations of motion for each rigid body, which was listed with six coordinates ,Lagrange equations , multipliers and the corresponding constraint equations:

$$\frac{d}{d_t}\left(\frac{\partial K}{\partial \dot{q}_j}\right)-\frac{\partial K}{\partial q_j}+\sum_{i=1}^{n}\frac{\partial \psi_i}{\partial q_j}\lambda_i = F_j \qquad (1\text{-}1)$$

$$\psi_i = 0 \quad \left(i=1,2,...,m\right)$$

K----Kinetic system expression ;

q_j ---- Generalized coordinates of the system;

ψ_i ---- Constraint equation of the system;

F_i ---- Generalized force of generalized coordinate direction

λ_i ---- Lagrange multipliers matrix

The equations of motion of rigid multi-body system was listed:

$$\frac{d}{d_t}\left(\frac{\partial K}{\partial \dot{q}_j}\right)-\frac{\partial K}{\partial q_j}+\sum_{i=1}^{n}\frac{\partial \ddot{O}_i}{\partial q_j}\lambda_i - F_j = 0 \qquad (1\text{-}2)$$

$$(j=1,2,...,6)$$

$$q=\left(x,y,z,\psi,\theta,\varphi\right)^T$$

First order kinematic equations:

$$\left.\begin{aligned} \dot{x}-v_x &= 0\\ \dot{y}-v_y &= 0\\ \dot{z}-v_z &= 0\\ \dot{\psi}-\omega_\psi &= 0\\ \dot{\theta}-\omega_\theta &= 0\\ \dot{\varphi}-\omega_\varphi &= 0 \end{aligned}\right\} \qquad (1\text{-}3)$$

There are also constrained algebraic equations, external definitions and custom algebraic differential equations.

System constraint equation $\varphi\left(\dot{q},q,t\right)=0$ (1-4)

System force equation $F\left(\dot{u},u,q,f,t\right)=0$ (1-5)

Custom differential equation $diff(\dot{u},u,q,f,t)=0$ (1-6)

q ----Generalized Cartesian coordinates

u ----Differential generalized coordinates

f ----Constraint

t -----Time

2. SYSTEM PROTOTYPE MODELING
In this paper, to achieve quick-return function, the composite body was designed according to the rotation of the guide-bar mechanism and crank slider mechanism . Kinematic diagram was shown Figure 1.

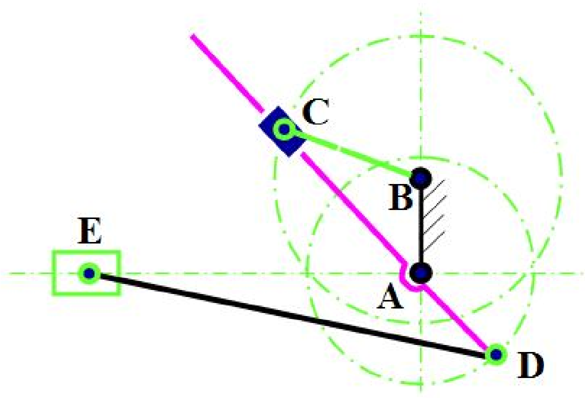

Figure 1. Kinematic Diagram

BC pole was the inputing member,slider E was the outing member.The votating velocity of Pole BC was constant.At the same time , the torque was given to pole BC.

3. SIMULATION

3.1 Force and Motion Analysis Inputting Element

When the input member was given uniform rotation velocity , the interaction force between the input member and the frame was as shown in figure 2.

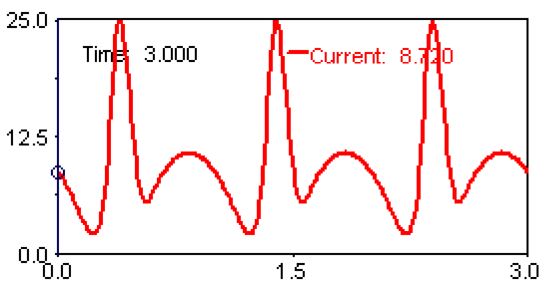

Figure 2. The force and time of input member

The angular displacement of the input member and the time change map was shown in Figure 3.

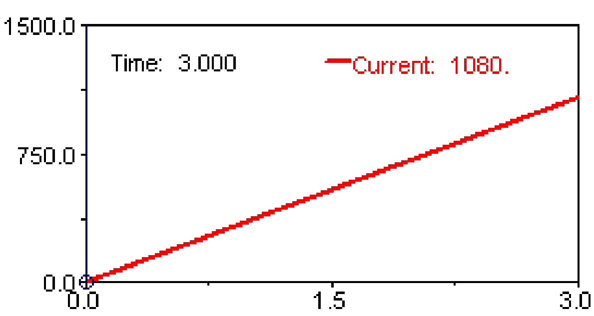

Figure 3. The angular displacement and time of input member

3.2 Force and Motion Analysis Link

The rajectory of each point of link was complex . In this paper, the midpoint of the rod motion was analysized as the research object, because the approximate midpoint of the motion of the link was thought as the surrounding center. The midpoint of the link displacement and time was shown in Figure 4.

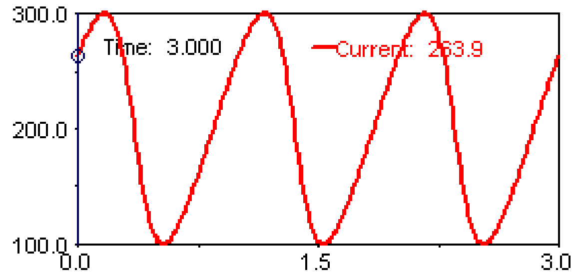

Figure 4. The displacement and time of link

The midpoint of the link velocity and time was shown in Figure 5.

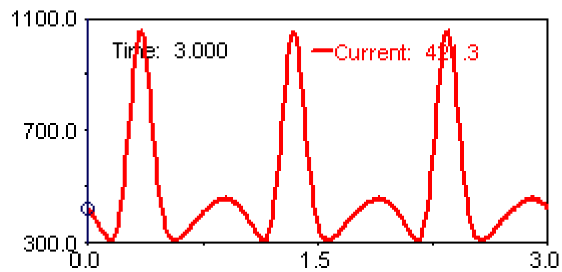

Figure 5. The velocity and time of link

The midpoint of the link acceleration velocity and time was shown in Figure 6.

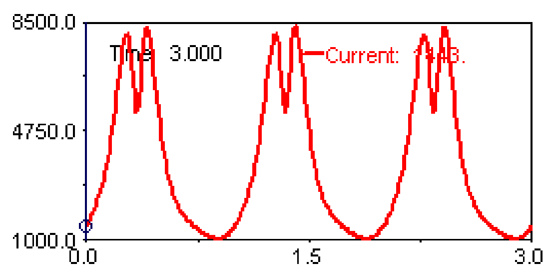

Figure 6. The acceleration velocity and time of link

The angular displacement of the link in Figure 7, the slider as a reference point.

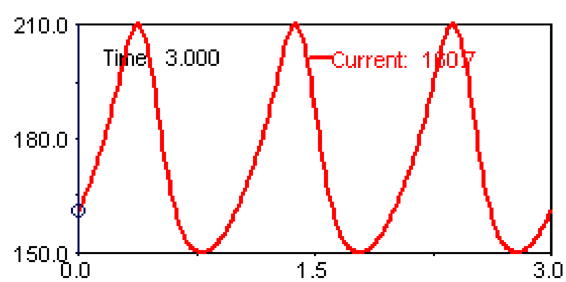

Figure 7. The angular displacement and time of link

3.3 Force and Motion Analysis Slider

The output parameters and performance requirements of slider as an output member were particularly important. The displacement of slider was shown in Figure 8.

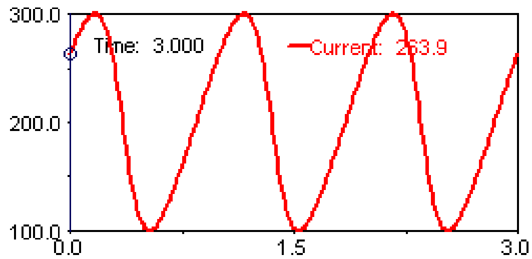

Figure 8. The displacement and time of slider

The slider velocity and time was shown in Figure 9.

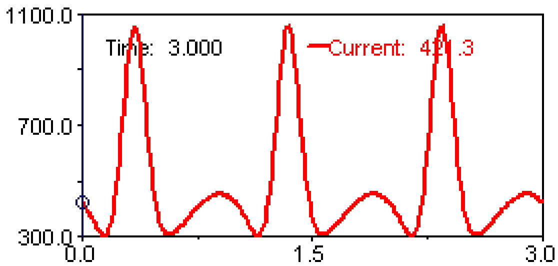

Figure 9. The velocity and time of slider

The slider acceleration velocity and time was shown in Figure 10.

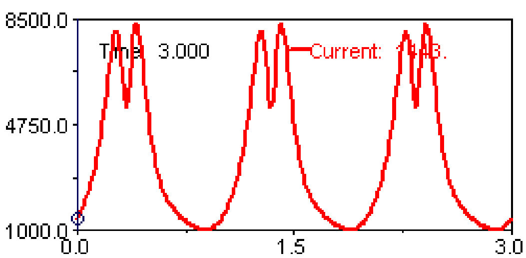

Figure 10. The acceleration velocity and time of slider

The force of slider and time was shown in Figure 11.

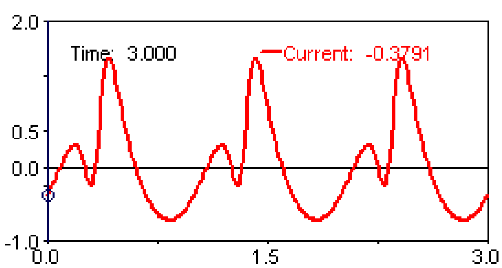

Figure 11. The force and time of slider

4. CONCLUSION

1.Five factors influencing the forming results were as follows: initial sheet size, BHF, punch and die gap ,friction factor between the die and the sheet metal, and friction factor of punch and blank holder and the sheet metal.

2. The initial size of the sheet and BHF have greater impact on the results, molds and sheet metal friction factor, the gap of the punch and die have less impact on the results.

3. Fender of car was not too complex exterior parts in the automotive parts, if complex automotive parts for analysis, then, the obtained results should be made the necessary corrections.

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