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Review Article

The Modeling for Flywheel Mass with Parameters of Crank & Linkage in Engine

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Abstract: The mass of flywheel will incline as the punch speed inclines; it will decline as radius inclines. It would incline when the punch mould mass inclines. So it is chosen that big radius and small mould mass for saving cost of material and machine. The biggest mass of flywheel is about 10Kg at 0.1m of radius and 7Kg of piston at the time of 0.06s and crank length R=75mm and linkage length L=255mm. So it is important for us to choose the piston mass. If it is 5Kg the biggest one will 10Kg at the time of 0.06s and crank length R=80mm and linkage length L=245mm then choosing crank length is second factor.

Keywords: Modelling; flywheel; piston mass; radius; engine; parameter; cost control.

1. INTRODUCTION

The flywheel is used widely in punch machine since it has much function. For instance it has reserved energy relieved impact and speed, it has many places to apply in modern industrial field. So it needs to be investigated in detail with a certain parameters for its wide usefulness in many machines. So in this study the flywheel mass with the rotation speed and its radius is modeled to find a certain intrinsic relations for process of motor housing punch. As we knew the flywheel is key part in punch machine in current factory. It can make many kinds of components for vehicle transformer and motor. Its role is important due to automatic production line. Moreover the few people is wanted there so many variable capital is saved. Its profit is huge for satisfying immense market demand. If machine happens to wrong the flywheel is key. Because its big rotary inertia and gravity it will deviate the central position. So the error will happen too. Because it can reserve the big energy to stabilize function to maintain a certain speed and force. Through different parameters to analyze the flywheel mass difference to find the design control method. Meantime by five parameters to look for the intrinsic correlation among them. Some methods are concluded in this study for production line convenience and reasonable designing and production feasibility. Smooth regulation is necessary and intelligent in production maker with piston mass and speed etc. For the artificial intelligence making the necessary value is grasped some that may relieve production burden. Further convenient communication with supplier will be feasible they can transform from simple supplier to major supplier link. The status is changed if so the stable and intelligent supply will be planted in future. If so the stabler and more developed company will be exhibited. The communication among us and suppliers will be strength more and more to skill complement in a period time. Two wins will be attained in a community. Furthermore in the design division the main parameters will be mastered further in order to happen low power phenomena [1-6].

The flywheel is fixed to machine rotary shaft that has bigger inertia of wheel reserved energy machine. When machine inclines the flywheel has high energy to reserve kinetic energy. Meantime when the machine speed declines the flywheel inclines for releasing the energy. The flywheel is used to incline speed wave in mechanical rotation [7].

Overview controlling flywheel mass is a significant matter so the relationship between their parameters which includes crank length and linkage length will be found too.

2. MODELING

According to Figure 1 which is kinematic graphs on the flywheel and crank linkage in engine in vehicle. From Figure 2 it is supposes that crank r_2=50mm , 60mm, 70mm and 80mm. A is sliding piston and cylinder wall; v is flywheel speed; n is shaft rotation; m_2 is .flywheel mass.
According to energy conservation principle it has

$$\frac{1}{2}m_1v^2=\frac{1}{2}m_2I_2\omega_2{}^2 \text{ ---(1)}$$

Here it is supposed that flywheel has average disc shape since rotary inertia is

$$I_2=\frac{1}{2}m_2r_2{}^2 \text{ ---(2)}$$

Formula (2) substitutes to (1) it has

$$m_2=2m_1v^2/(r_2\pi n/30)^2 \text{ --(3)}$$

It causes the m formula as (3).
It has

$$v=\pi dn\cdot\sin\theta_1/60 \ = \pi dn\cdot\sin(2\pi nt/60) \text{ ---(4)}$$

This is the relation between piston v and crank shaft n.

Here I_2 is rotary inertia to axis in flywheel; r_2 is its radius as above, m; m_2 is its mass, Kg; ω_2 is its rotation, r/min; m_1 is piston mass.

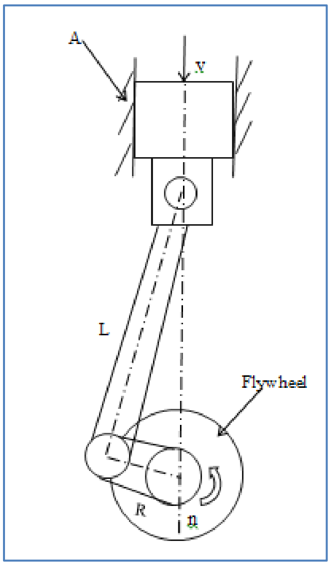
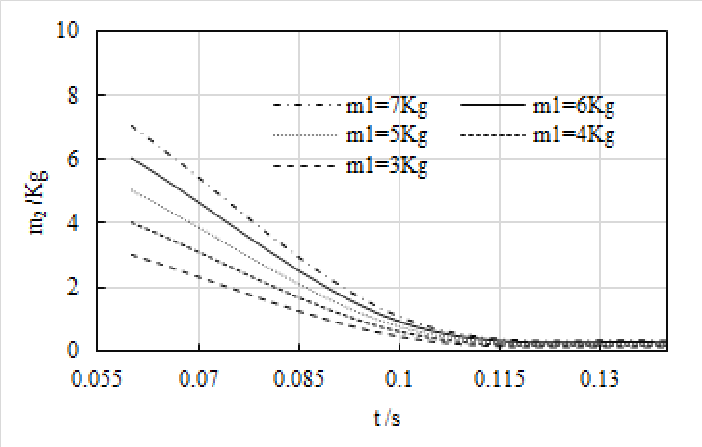


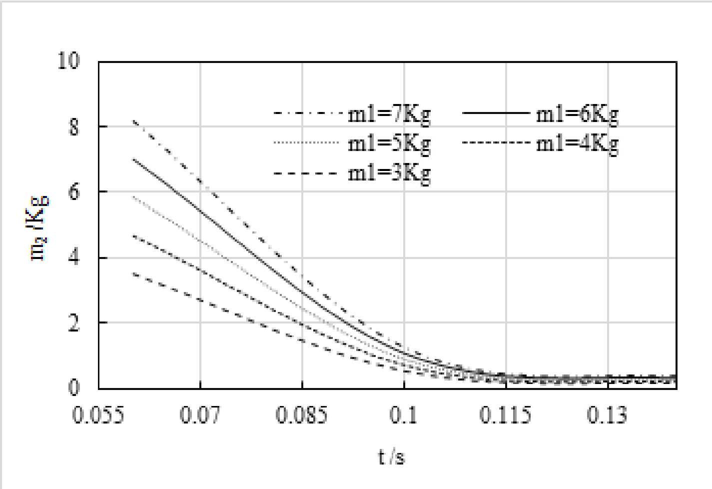
Fig-1: Kinematic schematic of the flywheel and crank linkage and crankshaft mechanism in the engine of vehicle

3. DISCUSSIONS

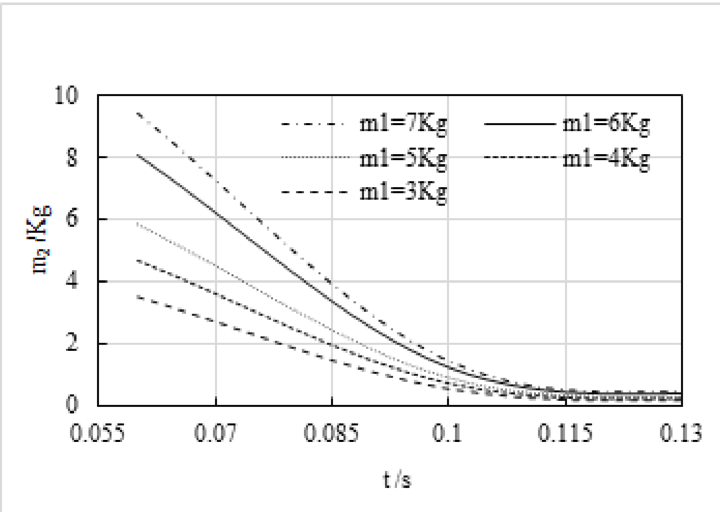
The relation between flywheel mass and parameters are calculated in this paper. Here parameters are piston mass m1, flywheel radius r and mass. They will be discussed in detail as below. The piston mass m is adopted by 3Kg, 4Kg, 5Kg, 6Kg and 6Kg whilst crank length R and linkage length L is from 60mm, 65mm, 70mm and 75mm and 240mm, 245mm, 250mm and 255mm respectively here. The mass of piston and R &L is adopted to 100r/m~ 3000r/m the flywheel mass may be gained through calculation as below drawing.



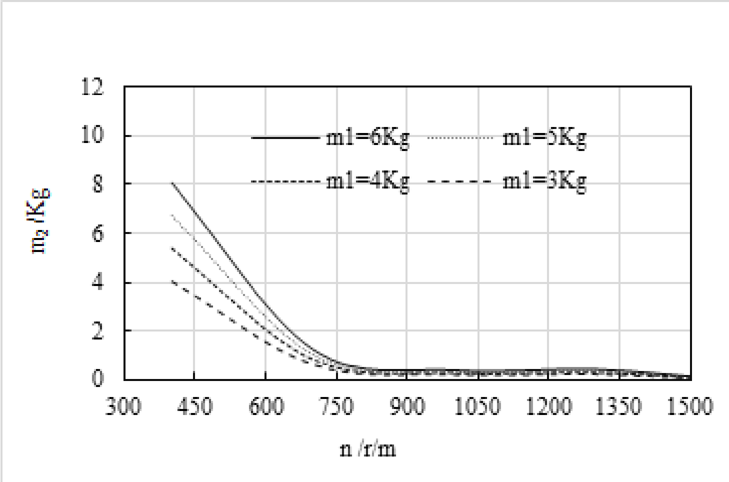
(a) R=65mm; L=240mm



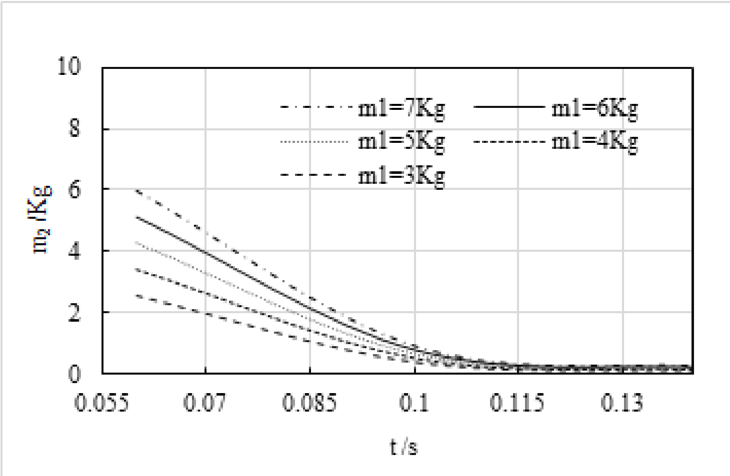
(b) R=70mm; L=255mm



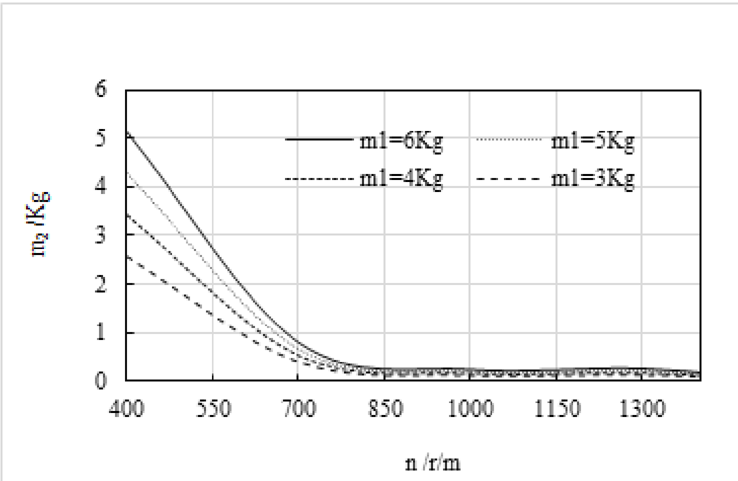
(c) R=75mm; L=255mm



(d) R=75mm; L=255mm

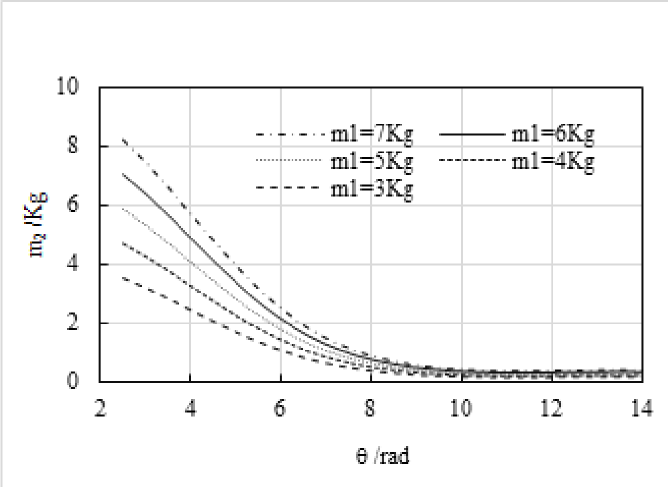


(e) R=60mm; L=240mm

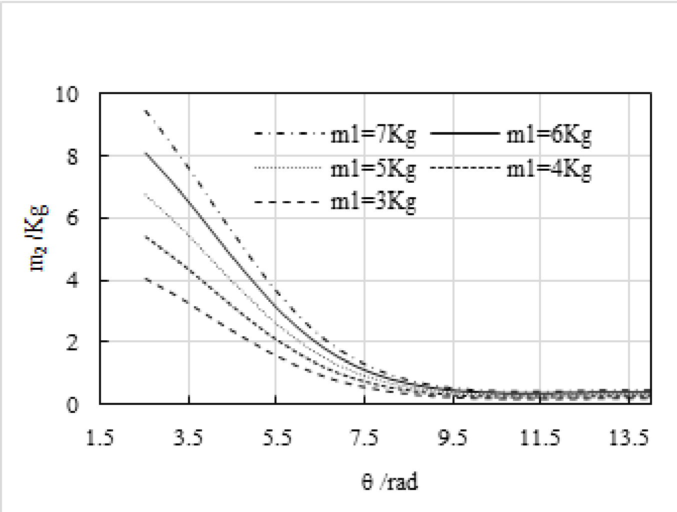


(f) R=60mm; L=240mm

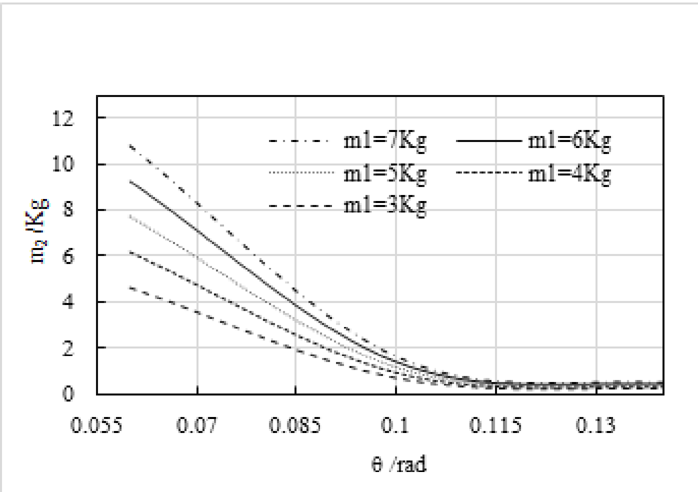
Fig-2: the curve of mass m_2 and time & rotation for flywheel at radius for r=0.1m with increasing rotation with crank length R=60mm~75mm & linkage length L=240mm and 255mm in engine.



(a) R=70mm; L=240mm



(b) R=75mm; L=240mm



(c) R=80mm; L=245mm

Fig-3: The curve of mass m_2 and crank angle at radius for r=0.1m with crank length R=70mm~80mm & linkage length L=240mm in engine.

The curve between flywheel mass and time & rotation is searched as seen in Figure 2(a~f) which is in terms of time & rotation and Figure 3(a~c) which is in terms of crank angle. It is found that no proportional relation exists. So choosing little piston mass will help us save machine cost. When the flywheel attains 100Kg of its mass the piston mass is 7Kg. When its mass is below 6Kg it will decline. Choosing the piston mass is necessary in piston design. If the value sent to maker the good effectiveness will be arrived for customer us and even both. It can be according to making course and after that with measurement. It can also proposed with modelling to correct deviation too. At the other side the mass of piston will be taken a role in design piston. Because it may affect the result of flywheel mass the course will be consideration factor. Use Lagrange formula to calculate to guarantee the parameter transfer. So the correct mass will be proposed upon it. The minimum one is mentioned as above with 3Kg.

4. CONCLUSIONS

The biggest flywheel mass with 100Kg will be arrived when piston mass is 7Kg and flywheel radius is 0.1m. it can be thought that below 7Kg is reasonable one for saving cost. The largest one with 100Kg will be arrival when it is radius is 0.1m and R=80mm and L=245mm. so the crank length R and linkage length L is first effect factor and then the piston mass in this paper ie.R>L & R>m turn. According to this turn it may be designed reasonable flywheel mass. For the sake of cost declining the flywheel construction will be designed better than current is possible according to this study data. From the optimum views the low cost and low materials will be controlled in terms of the industrious demand.

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