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Rotational Kinetic Energy Will be More If Collision at the Rod's End

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Abstract:

In this paper I tried to setup a system in which a body (square's mass with rod connected) after collision with the obstacle(p) at one end, it will rotate with angular velocity(***ω***) (due to conservation of angular momentum) which gives more rotational energy than the body moving with constant velocity(translational), for more we have drawn 2 figures in which collision has shown. This idea can change the system of energy production and it is more efficient and environmentally friendly. This paper is based on theoretically not experimentally. It may be model for the engineers to harness the energy and mitigate the climate change.

Keywords **—conservation of angular momentum, rotational kinetic energy, moment of inertia**

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I. INTRODUCTION

As we know that energy is very essential and the problem is that it is scarce and conventional source of energy production is not eco-friendly. Today we have seen around that there is lot of research is going on the solar and wind energy but these sources are still under progress to make more efficient. Solar energy stand as June 2024 is 85.47 GW and its potential is 748 GW [1]. On the other side we can see that potential of wind energy is low and it is not accessible at every place.

Energy generation in this paper is occurred due to collision of small obstacle with body (rod connected with square mass) at one end. Due to collision, it will rotate with angular velocity (ω). After collision we calculated the rotational kinetic energy of the body. Rotational Kinetic energy was higher than translational kinetic energy.if we consider mass of rod is small,then there is large rotational kinetic energy as compare to translational kinetic [2]

YOU CAN SEE THE FIGURE NO 1

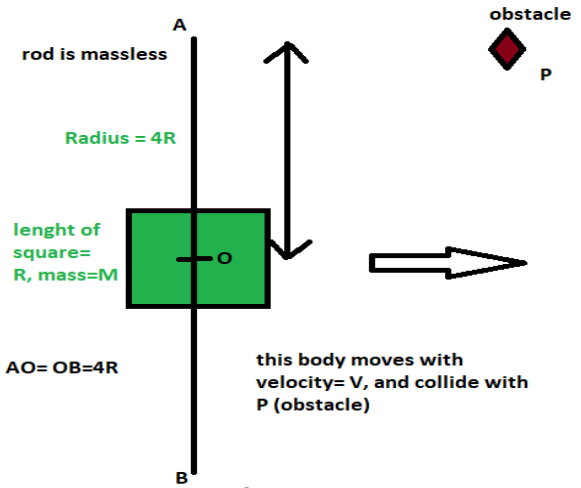

fig. 1

In the above figure no 1. You can see that there are two bodies (square mass with rod) which is connected and centre of mass of the bodies is at "O".

Discussion:

As we can see that above body moving with velocity 'V' and rod are perpendicular to the horizontal axis.

So translational kinetic energy = ½ (M * V^2)…..(1)

this body now collide with obstacle(P) at one of the end of the rod , due to collision angular momentum will conserved , after collision the rotational kinetic energy will be higher than translational kinetic energy.

Figure no 2.

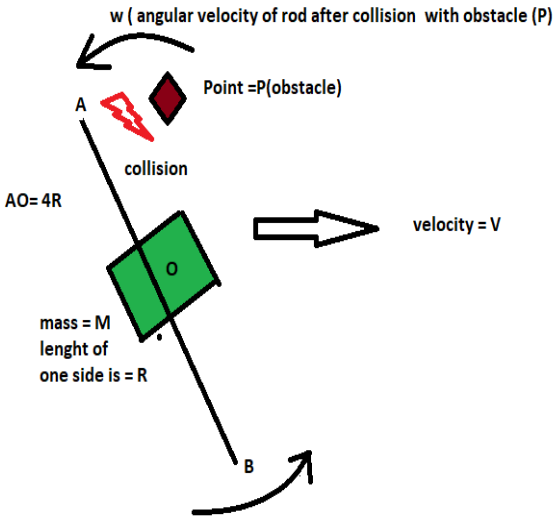

fig. 2

We can see the above figure no 2. There is collision in which point P was collide with point A (end of the rod).

We can calculate the rotational kinetic energy of the body.

Rotational kinetic energy (R KE)=1/2(moment of inertia * ω^2

Moment of inertia = MoI of square + MoI of rod =(MR^2 /6) + $m(8R)^2$/12 ……..(2)

According to conservation of angular momentum

Angular momentum before collision = angular momentum after collision (we neglect the rod's mass)

M*V*4R = Inertia * ω……(3)

M*V*4R= MR^2/6*ω

ω=24*V/R=> RKE=1/2(inertia)*(ω)^2

We found that

rotational kinetic energy= ½(M* V^2* 96) in the above equation. Rotational energy is 96 times of translational kinetic energy

if we consider the mass of rod but it should be less than the square's mass like m=M/5(where M=5 kgs)

we get rotational kinetic energy =

(M+m)*V*4R=[MR^2/6 +M$(8R)^2$/5*12]….(4)

M=5*m……(5)

After calculation , add values ,V=10 m/s, M=5 kgs

We get,Rotational kinetic energy = 3,243.24Joules

whereas translational kinetic energy =300 J

We can see that if we take small mass of rod then we can neglect it and it gives around 96 times of translational kinetic energy .[3]

If we consider mass of rod 'M/5' then energy of rotational kinetic energy is around 10 times more.

In this system energy generation occurred more because of extended length of rod and its mass was neglected and length at the centre which is '4R', then point P was collide at at the end of point A so that radius is large for collision which gives more angular momentum (because mass is not at periphery), it means inertia is less ,and due to

conservation of angular momentum , angular velocity will be more , hence

Rotational kinetic energy will be more .

Conclusion:

Any body moving with velocity 'V' and linear then perpendicular distance from the axis of rotation will give angular momentum =M*V* L ,here in the above cases angular momentum is M*V*4R = I ω

As we extended the rod's length with less mass, then after collision, 'I' was less and angular velocity will be more, which it gives finally more rotational kinetic energy.

Finally we can harness the energy but engineers and scientist need to work further to make perfect machine which gives more energy and sustainable and eco-friendly.

REFERENCES:

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[2] Resnik and Halliday Physics
[3] NCERT – class 11th
[4] S.L Arora (Physics part 1)

