SHORT COMMUNICATION

THE CHALLENGING CONCEPT OF DISPLACEMENT IN BASIC CLASSICAL MECHANICS

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Abstract. *In this paper we challenge concept of displacement in basic classical mechanics. In fact we show that displacement defined in basic mechanics books, it seemed that not full because in the different instances this matter is clear. We tried to offer some examples show that what our means.*

Keywords: *Displacement-velocity-average velocity.*

1. INTRODUCTION

In the basic mechanics displacement is vector that to connect start of motion and end of motion [1]. We believe this definition is not careful. Some times for instance displacement has the conception of relativity. In case you can follow this problem in [2]. In matter fact in this paper you will see in general it's essential that we have better definition for the displacement. We attempt to present comprehensive and proper instances show that the manner of educate of these conceptions (displacement and average velocity) can be point out by another look. We start our discussion with following example.

2. EXAMPLE 1

In the following figure we see the body moves on the frictionless linear length L and speed V. This body is dislocated from point of A to point of B. Another body moves on the second trajectory that similar to before length L and speed V. Also this body is displacing point of C to the D.

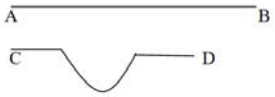

Fig. 1.

Now if we consider displacement as vector that connects start and end of path then bodies the diagram of speed-time.

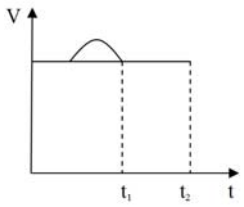

Fig. 2.

Obviously $\overline{V}_{CD} > \overline{V}_{AB}$, for the compare of time of these two paths it's necessary that displacement of them is same.

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3. EXAMPLE 2

Fig. 3 shows that object moves on the linearly path with length L and constant speed V. Also it moves in the semicircle path with length x and speed V(x) so that V(x) =V f(x).

Fig. 3.

Now we draw diagram of speed-time of this object. In this diagram t_1 is instant related of linear path and t_2 is instant that object traveled semicircle path.

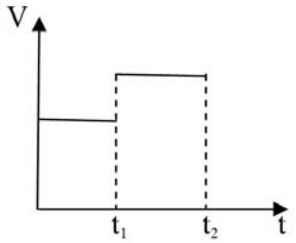

Fig. 4.

The area of under diagram is equal to L+ x so that it's incompatible with vector that connects A to B. Then we define displacement as following:

Displacement is a vector so that the magnitude of it is the area of under diagram of speed-time and the direction of it is average velocity vector.

In above example t_1 and t_2 can be writing as following

$$t = t_1 + t_2 = \frac{l}{V} + \frac{x}{V(x)} = \frac{l}{V} + \frac{x}{Vf(x)} = \frac{1}{V}\left(l + \frac{x}{f(x)}\right) \quad (1)$$

Then the equation of motion in the two paths is uniform.

In the uniform motion circle both of velocity and acceleration are constant so what is the equation of motion? Our means is that the equation of uniform motion is proper or the equation of constant acceleration motion. Based on the above discussion we conclude here the equation of uniform motion is proper so we have $x = Vt$.

If we choose x as environment of circle with radius R then

$$2\pi R = VT$$

and

$$V = \frac{2\pi R}{T} \quad (2)$$

4. CONCLUSIONS

We conclude from above discussion displacement in basic mechanics have to define as following: Displacement is a vector so that the magnitude of it's the area of under diagram of speed-time and in the same direction with average velocity vector.

REFERENCES

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