THE 18.821 MATHEMATICS PROJECT LAB REPORT [PROOFS]

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1. Theorems

1.1. Notation.

t: Time
l: Path length
s: Speed
a_T: Tangential acceleration
a_C: Centripetal acceleration
$\vec{x}$: Position
$\vec{v}$: Velocity
$\vec{a}$: Acceleration

2. Cylindrical Coordinates Calculus

$$\mathbf{r} = r\hat{\mathbf{r}} \tag{1}$$

$$\dot{\mathbf{r}} = \dot{r}\hat{\mathbf{r}} + r\dot{\phi}\hat{\phi} \tag{2}$$

$$\ddot{\mathbf{r}} = \left(\ddot{r} - r\dot{\phi}^2\right)\hat{\mathbf{r}} + \frac{1}{r}\frac{d}{dt}\left(r^2\dot{\phi}\right)\hat{\phi} \tag{3}$$

3. Theorems

Theorem 3.1. *For a given speed and bounded centripetal acceleration, it is always optimal to minimize the turning radius. This turning radius is*

Proof. Well, yes. □

References

[1] `http://en.wikipedia.org/wiki/Polar_coordinate_system`

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