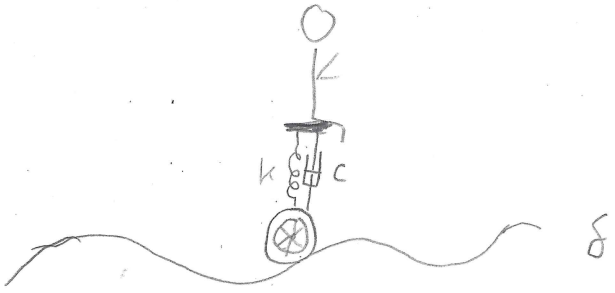
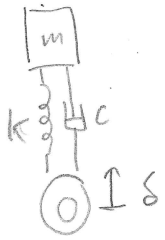
20-R-VIB-DY-40

A unicycle's suspension has a spring, k = 1000 N/m, and damper 500 Ns/m, for the m = 75 kg driver's comfort. The biker goes over a bumpy road, which can be described as $\delta = 0.5 \sin 10t$. What is the velocity of the unicycle if delta the amplitude of vibration is 0.05 m.



Solution:



$F = k\delta \qquad F/k = \delta$

$\omega_n = \sqrt{\frac{k}{m}} = 3.65$ rad/s

$\tau = \frac{2\pi}{\omega_n} = 1.72$ s

$\lambda = 10$

$V_n = \frac{\lambda}{\tau} = \frac{10}{1.72} = 5.814$ m/s

$$D = \left| \frac{\delta}{1-\left(\frac{V_0}{\omega_n}\right)^2} \right| = 0.05 \text{ m}$$

$$\left| \frac{0.5}{1-\left(\frac{V}{V_n}\right)^2} \right| = 0.05 \text{ m}$$

$$1-\left(\frac{V}{V_n}\right)^2 = -10$$

$V = 19.28$ m/s