國立彰化師範大學 97 學年度碩士班招生考試試題

系所：機電工程學系碩士班　　組別：甲組　　科目：動力學

☆☆請在答案紙上作答☆☆　　

共 4 題，每題 25 分，滿分 100 分。

1. The top has a mass of 1 kg and can be considered as a solid cone, shown in the Fig. 1. If it is observed to precess about the vertical axis at a constant rate of *5 rad/s*, determine its spin ω_s given $\theta = 30^{\circ}$, L = 0.16 m, r = 0.04 m.

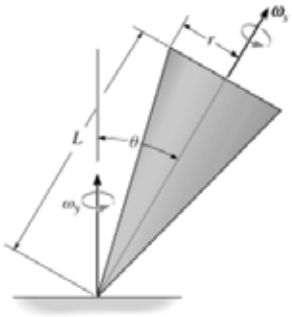


Fig. 1

2. The bar has a weight of 5 lb. If the stiffness of the spring is 8 lb/ft, and the dashpot has a damping coefficient 60 lb*s/ft, and a = 2 ft as well as b = 3 ft, shown in the Fig. 2. The differential equation which describes the motion in terms of the angle θ of the bar's rotation is $\left(\frac{W}{g}\right)\frac{(a+b)^2}{3}\ddot{\theta} + cb^2\dot{\theta} + k(a+b)^2\theta = 0$. Determine the damping coefficient of the dashpot if the bar is to be critically damped.

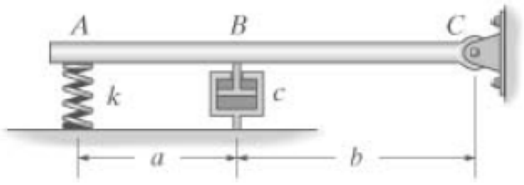


Fig. 2

3. A 0.4 kg spool slides down along a smooth rod, shown in the Fig. 3. If the rod has a constant angular rate of rotation $\dot{\theta} = 3\,rad/s$ in the vertical plane, and N_s is the magnitude of the normal force of the rod on the spool. If $r, \dot{r}$ and θ are zero when $t = 0$, determine r at the instant $\theta = 45^0$ (Hint: the one solution of these equations of motion for the spool is $r = C_1 e^{-\dot{\theta}t} + C_2 e^{\dot{\theta}t} - (g/2\dot{\theta})\sin(\dot{\theta}t)$).

國立彰化師範大學 97 學年度碩士班招生考試試題

系所：機電工程學系碩士班　　組別：甲組　　科目：動力學

☆☆請在答案紙上作答☆☆　　

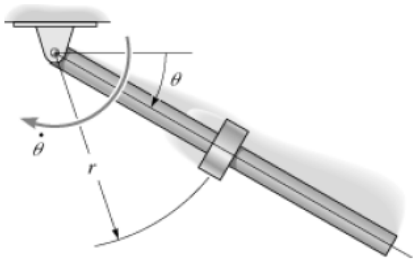


Fig. 3

4. The solid ball of mass m is dropped with a velocity V_{ver} onto the edge of the rough step, shown in the Fig. 4. If it rebounds horizontally off the step with a velocity V_{hor}, and the coefficient of restitution is *e*, determine the angle ψ at which contact occurs. Assume no slipping when the ball strikes the step.

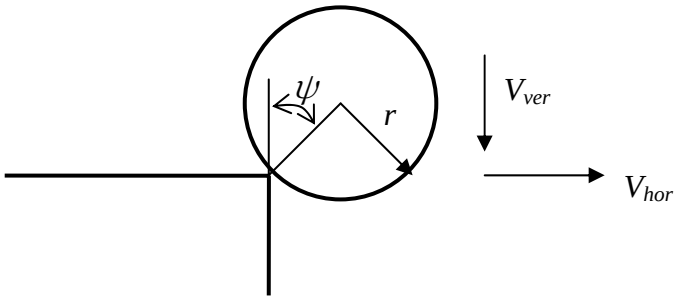
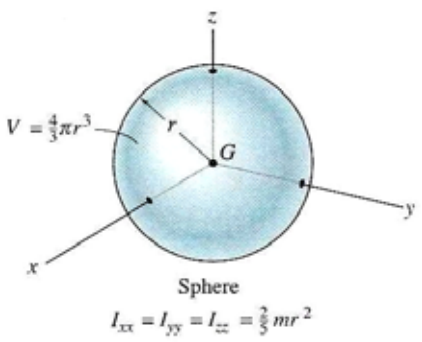


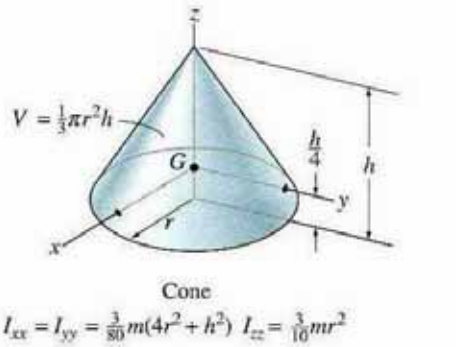
Fig. 4

Supplementary



Sphere

$I_{xx} = I_{yy} = I_{zz} = \frac{2}{5}mr^2$



Cone

$I_{xx} = I_{yy} = \frac{3}{80}m(4r^2 + h^2)$ $I_{zz} = \frac{3}{10}mr^2$