In[8]:=
```
M = -kappa * theta[t]
I * theta''[t] = -kappa * theta[t]
I = 1 / 2 m * R^2
DSolve[{(1 / 2 m * R^2) * theta''[t] == -kappa * theta[t],
  theta[0] == theta0, theta'[0] == alpha0}, theta[t], t]
```

Out[8]= $-\text{kappa}\,\text{theta}[t]$

Set::write : Tag Times in i theta''[t] is Protected. ≫

Out[9]= $-\text{kappa}\,\text{theta}[t]$

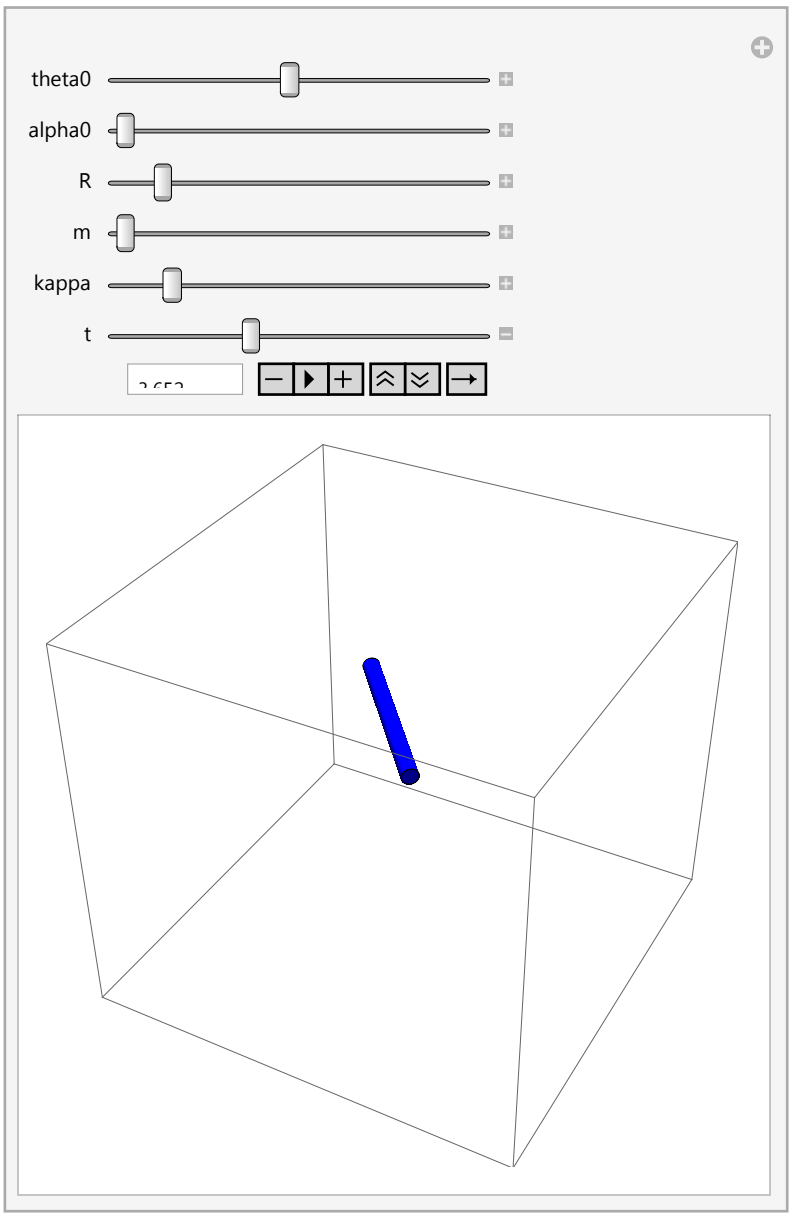
Set::wrsym : Symbol i is Protected. ≫

Out[10]= $\frac{m R^2}{2}$

Out[11]=
$$\left\{\left\{\text{theta}[t] \to \frac{1}{2\sqrt{\text{kappa}}}\left(2\sqrt{\text{kappa}}\ \text{theta0}\,\text{Cos}\left[\frac{\sqrt{2}\ \sqrt{\text{kappa}}\ t}{\sqrt{m}\ R}\right] + \sqrt{2}\ \text{alpha0}\ \sqrt{m}\ R\,\text{Sin}\left[\frac{\sqrt{2}\ \sqrt{\text{kappa}}\ t}{\sqrt{m}\ R}\right]\right)\right\}\right\}$$

In[20]:=
```
Manipulate[{
   theta = (2 Sqrt[kappa] theta0 Cos[(Sqrt[2] Sqrt[kappa] t)/(Sqrt[m] R)] + Sqrt[2] alpha0 Sqrt[m] R Sin[(Sqrt[2] Sqrt[kappa] t)/(Sqrt[m] R)])/(2 Sqrt[kappa]);
   Graphics3D[
    {Blue, Cylinder[{{0, 0, 0}, {R * Sin[theta], R * Cos[theta], 0}}, 0.001]},
    PlotRange → {{-1.1 * R, 1.1 * R}, {-1.1 * R, 1.1 * R}, {-R, R}}
   ]
  }[[1]],
 {{theta0, π / 4}, 0, π / 2},
 {alpha0, 0, π / 2},
 {R, 0.001, 0.2},
 {m, 0.1, 1},
 {kappa, 0.1, 10},
 {t, 0, 10}
]
```

Out[20]=



In[35]:=
```
m1 = 0.02;
m2 = 0.03;
l1 = 0.3;
l2 = 0.4;
θ10 = 25 * π/180;
θ20 = 5 * π/180;
ω10 = 0;
ω20 = 0;
g = 10;
sol = NDSolve[{(m1 + m2) l1^2 θ1''[t] + m2 * l1 * l2 * θ2''[t] * Cos[θ1[t] - θ2[t]] +
      m2 * l1 * l2 * (θ2'[t])^2 * Sin[θ1[t] - θ2[t]] + l1 * g * (m1 + m2) * Sin[θ1[t]] == 0,
   m2 * l2^2 θ2''[t] + m2 * l1 * l2 * θ1''[t] * Cos[θ1[t] - θ2[t]] -
      m2 * l1 * l2 * (θ1'[t])^2 * Sin[θ1[t] - θ2[t]] + l2 * m2 * g * Sin[θ2[t]] == 0,
   θ1[0] == θ10, θ2[0] == θ20, θ1'[0] == ω10, θ2'[0] == ω20}, {θ1[t], θ2[t]}, {t, 0, 10}]
Plot[{Evaluate[θ2[t] /. sol][[1]], Evaluate[θ1[t] /. sol][[1]]},
 {t, 0, 10}, PlotRange → Full]
```

Out[44]=
```
{{θ1[t] → InterpolatingFunction[{{0., 10.}}, <>][t],
  θ2[t] → InterpolatingFunction[{{0., 10.}}, <>][t]}}
```

Out[45]=