Goldstein

1.19. $T = \frac{1}{2}m\left[(l\dot{\theta})^2 + (l\dot{\phi})^2\right]$

$= \frac{1}{2}ml^2(\dot{\theta}^2 + \dot{\phi}^2)$

$V = mgl\cos\theta$

$L = \frac{1}{2}ml^2(\dot{\theta}^2 + \dot{\phi}^2) - mgl\cos\theta$

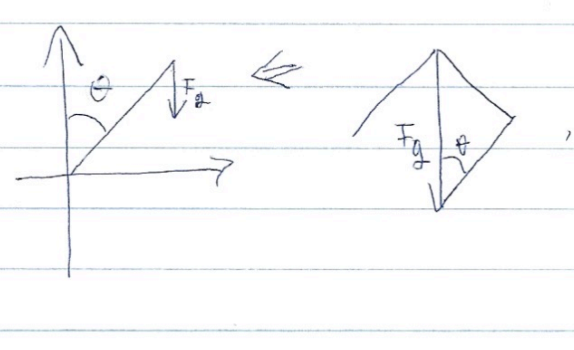
$\frac{dL}{d\theta} = mgl\sin\theta$, $\left[\frac{\partial L}{\partial\dot{\theta}}\right]^{\cdot} = ml^2\ddot{\theta}$

$\frac{dL}{d\phi} = 0$, $\left[\frac{\partial L}{\partial\dot{\phi}}\right] = ml^2\ddot{\phi}$

Eqm: $\begin{cases} mgl\sin\theta = ml^2\ddot{\theta} \\ ml^2\ddot{\phi} = 0. \end{cases}$

$ml^2\ddot{\phi} = 0$ ⇐ conservation of azimuthal angular momentum.

$mgl\sin\theta = ml^2\ddot{\theta}$ reduces to $g\sin\theta = l\ddot{\theta}$, $g\sin\theta$ is the tangential component of gravity, $l\ddot{\theta}$ is torque. So this equation is a statement of torque applied by gravity, which is ~~the~~ applied tangentially onto $\theta$-component.




, tangential component is $F_g\sin\theta$.

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