Phys 321 HW 31 CID 6265

① $\mathcal{L} = \frac{1}{2}\lambda_1(\dot{\phi}^2\sin^2\theta + \dot{\theta}^2) + \frac{1}{2}\lambda_3(\dot{\psi} + \dot{\phi}\cos\theta)^2$

Both $\phi$ and $\psi$ are ignorable coordinates. Thus,

$\frac{\partial \mathcal{L}}{\partial \phi} = \frac{\partial \mathcal{L}}{\partial \psi} = 0$ this means that $\frac{\partial \mathcal{L}}{\partial \dot{\phi}} = \text{const.}$ and $\frac{\partial \mathcal{L}}{\partial \dot{\psi}} = 0$

There is no change in the generalized momenta of $\phi$ or $\psi$ coordinates. These are the angles about $\hat{z}$ and $\hat{e}_3$, respectively. so

$$P_\phi = \frac{\partial \mathcal{L}}{\partial \dot{\phi}} = \lambda_1\dot{\phi}\sin^2\theta + \lambda_3(\dot{\psi} + \dot{\theta}\cos\theta)\cos\theta = \text{const.}$$

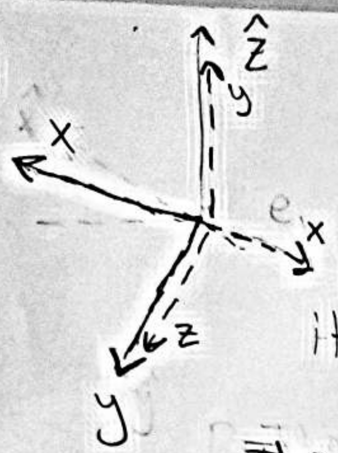
and

$$P_\psi = \frac{\partial \mathcal{L}}{\partial \dot{\psi}} = \lambda_3(\dot{\psi} + \dot{\phi}\cos\theta) = \text{const.}$$

The momentum associated w/ $\phi$ and $\psi$ is angular, according to the nature of the situation. Since $P_\phi$ is constant, then, the angular momentum component along $\hat{z}$ is conserved ($L_z$)

Also, since $P_\psi$ is constant, the angular momentum component $L_3$ is conserved along $\hat{e}_3$.

(2)




The object is first turned to the side 90°. Then it is flipped "forward" 90°. Then it it turned 90° again.

The body's x axis will point antiparallel, along the original x axis. The body's y axis will point dirctly along the original z axis, parallel to it. The body's z axis will point directly along the original y axis, parallel to it.