HW Feb 25, Johannes Byle

6.2

$$\frac{\delta f}{\delta q} - \frac{d}{du}\frac{\delta f}{\delta q'} = 0$$

We also already know that length in cylindrical coordinates are $rd\phi$ and dz thus:

$$L = f = \sqrt{R^2\dot{\phi}^2 + \dot{z}^2}$$

$$\frac{\delta f}{\delta \phi} = 0$$

$$\frac{\delta f}{\delta z} = 0$$

$$\frac{\delta f}{\delta \dot{\phi}} = \frac{R^2\dot{\phi}}{\sqrt{R^2\dot{\phi}^2 + \dot{z}^2}}$$

If we assume the $\sqrt{R^2\dot{\phi}^2 + \dot{z}^2}$ is constant:

$$\frac{d}{dt}\frac{\delta f}{\delta \dot{\phi}} = \frac{R^2\ddot{\phi}}{\sqrt{R^2\dot{\phi}^2 + \dot{z}^2}}$$

$$\frac{\delta f}{\delta \dot{z}} = \frac{\dot{z}}{\sqrt{R^2\dot{\phi}^2 + \dot{z}^2}}$$

If we assume the $\sqrt{R^2\dot{\phi}^2 + \dot{z}^2}$ is constant:

$$\frac{d}{dt}\frac{\delta f}{\delta \dot{z}} = \frac{\ddot{z}}{\sqrt{R^2\dot{\phi}^2 + \dot{z}^2}}$$