Hamiltonian

$$\mathcal{H} = \frac{J_x^2}{2mr_0^2\left(\cos\left(q(t)\right)-1\right)} - \frac{J_y^2}{4mr_0^2} - \frac{J_z^2}{2mr_0^2\left(\cos\left(q(t)\right)+1\right)} - \frac{p^2(t)}{mr_0^2} \qquad (1)$$