

$$\begin{aligned}
\mathcal{L} = & \frac{1}{2}m\dot{x}^2 + \frac{1}{2}m\left(\frac{l^2}{4}\left(\sqrt{1-\left(\sin\varphi_{10}+\frac{x}{l}\right)^2}+\sqrt{1-\left(\sin\varphi_{20}+\frac{x}{l}\right)^2}\right)^2+\frac{a^2}{4}\right)\dot{\theta}^2 \\
& -mg\left(-x\sin\alpha+\left(\frac{a}{2}\sin\theta-\frac{l}{2}(1-\cos\theta)\left(\sqrt{1-\left(\sin\varphi_{10}+\frac{x}{l}\right)^2}+\sqrt{1-\left(\sin\varphi_{20}+\frac{x}{l}\right)^2}\right)\right)\cos\alpha\right) \\
& -\frac{1}{2}k\left(\begin{aligned} & \left(\arcsin\left(\sin\varphi_{10}+\frac{x}{l}\right)-\beta\right)^2+\left(\arcsin\left(\sin\varphi_{20}+\frac{x}{l}\right)-\beta\right)^2 \\ & +\left(\arccos\left(\sqrt{1-\left(\sin\varphi_{10}+\frac{x}{l}\right)^2}+\frac{x}{l}\tan\theta\right)-\beta\right)^2+(\varphi_{40}+\lambda\theta-\beta)^2 \end{aligned}\right)
\end{aligned}$$