

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