$$m\ddot{x} + mg\sin\alpha - \frac{1}{2}mg\cos\alpha\left(1 - \cos\theta\right) \left(\frac{\frac{x}{l} + \sin\varphi_{10}}{\sqrt{1 - \left(\frac{x}{l} + \sin\varphi_{10}\right)^2}} + \frac{\frac{x}{l} + \sin\varphi_{20}}{\sqrt{1 - \left(\frac{x}{l} + \sin\varphi_{20}\right)^2}}\right)$$

$$+\frac{k}{l} + \frac{\beta - \arcsin\left(\frac{x}{l}\sin\varphi_{10}\right)}{\sqrt{1 - \left(\frac{x}{l} + \sin\varphi_{10}\right)^{2}}} + \frac{\beta - \arcsin\left(\frac{x}{l}\sin\varphi_{20}\right)}{\sqrt{1 - \left(\frac{x}{l} + \sin\varphi_{10}\right)^{2}}} + \tan\theta\right) \left(-\frac{\frac{x}{l}\sin\varphi_{10}}{\sqrt{1 - \left(\frac{x}{l} + \sin\varphi_{10}\right)^{2}}} + \tan\theta\right) \left(-\frac{\frac{x}{l}\sin\varphi_{10}}{\sqrt{1 - \left(\frac{x}{l} + \sin\varphi_{10}\right)^{2}}} + \tan\theta\right)} - \frac{1}{\sqrt{1 - \left(\sqrt{1 - \left(\frac{x}{l} + \sin\varphi_{10}\right)^{2}} + \frac{x\tan\theta}{l}\right)^{2}}}\right)} + \frac{1}{\sqrt{1 - \left(\sqrt{1 - \left(\frac{x}{l} + \sin\varphi_{10}\right)^{2}} + \frac{x\tan\theta}{l}\right)^{2}}}\right)}$$

$$-rac{1}{4}ml\Biggl(rac{rac{x}{l}\sinarphi_{10}}{\sqrt{1-\Bigl(rac{x}{l}+\sinarphi_{10}\Bigr)^2}}+rac{rac{x}{l}\sinarphi_{20}}{\sqrt{1-\Bigl(rac{x}{l}+\sinarphi_{20}\Bigr)^2}}\Biggr)\Biggl(\sqrt{1-\Bigl(rac{x}{l}+\sinarphi_{10}\Bigr)^2}+\sqrt{1-\Bigl(rac{x}{l}+\sinarphi_{20}\Bigr)^2}\Biggr)\Biggr$$

$$=\mu m \left(g\coslpha \left(rac{rac{b}{2} + l\sinarphi_2}{b + l(\sinarphi_1 + \sinarphi_2)}
ight) \left(rac{1}{2} - rac{l}{a}\sin heta
ight) + \left(rac{h_C^2}{a} + rac{a}{4}
ight) \ddot{ heta}
ight)$$