Equations of motion: (for Runge-Kutta)

Let $\omega_1 \equiv \dot{\theta}_1 \Rightarrow \ddot{\theta}_1 = \dot{\omega}_1$

Let $\omega_2 \equiv \dot{\theta}_2 \Rightarrow \ddot{\theta}_2 = \dot{\omega}_2$

$$\dot{\omega}_1 = \frac{-g(2m_1+m_2)\sin\theta_1 - m_2 g\sin(\theta_1-2\theta_2) - 2\sin(\theta_1-\theta_2)\, m_2 (L_2\omega_2^2 + L_1\omega_1^2\cos(\theta_1-\theta_2))}{L_1(2m_1+m_2(1-\cos(2(\theta_1-\theta_1))))}$$

Setting $m_1=m_2=m$, $L_1=L_2=L$, we get

$$= \frac{-3gm\sin\theta_1 - mg\sin(\theta_1-2\theta_2) - 2m\sin(\theta_1-\theta_2)(L\omega_2^2 + L\omega_1^2\cos(\theta_1-\theta_2))}{L(\underbrace{2m+m}_{=3m} - m\cos(2(\theta_1-\theta_2)))}$$

$$= \frac{-3mg\sin\theta_1 - mg\sin(\theta_1-2\theta_2) - 2mL\sin(\theta_1-\theta_2)(\omega_2^2 + \omega_1^2\cos(\theta_1-\theta_2))}{mL(3-\cos(2(\theta_1-\theta_2)))}$$

$$\dot{\omega}_2 = \frac{2\sin(\theta_1-\theta_2)(\omega_1^2 L_1(m_1+m_2) + g(m_1+m_2)\cos\theta_1 + \omega_2^2 L_2 m_2\cos(\theta_1-\theta_2))}{L^2(2m_1+m_2-m_2\cos(2\theta_1-2\theta_2))}$$

$$= \frac{2\sin(\theta_1-\theta_2)(2mL\omega_1^2 + 2mg\cos\theta_1 + \omega_2^2 mL\cos(\theta_1-\theta_2))}{L(2m+m-m\cos(2\theta_1-2\theta_2))}$$

$$= \frac{2m\sin(\theta_1-\theta_2)\left[2(L\omega_1^2 + g\cos\theta_1) + \omega_2^2 L\cos(\theta_1-\theta_2)\right]}{mL(3-\cos(2\theta_1-2\theta_2))}$$

$\dot{\theta}_1 = \omega_1$

$\dot{\theta}_2 = \omega_2$