

$$\ddot{x}_1 = -\dot{\theta}_1^2 L_1 \sin \theta_1 + \ddot{\theta}_1 L_1 \cos \theta_1 \quad (1)$$

$$\ddot{y}_1 = \dot{\theta}_1^2 L_1 \cos \theta_1 + \ddot{\theta}_1 L_1 \sin \theta_1 \quad (2)$$

$$\ddot{x}_2 = \ddot{x}_1 - \dot{\theta}_2^2 L_2 \sin \theta_2 + \ddot{\theta}_2 L_2 \cos \theta_2 \quad (3)$$

$$\ddot{y}_2 = \ddot{y}_1 - \dot{\theta}_2^2 L_2 \cos \theta_2 + \ddot{\theta}_2 L_2 \sin \theta_2 \quad (4)$$

$$\cos \theta_1 (m_1 \ddot{x}_1 + m_2 \ddot{x}_2) = -\sin \theta_1 (m_1 \ddot{y}_1 + m_2 \ddot{y}_2 + m_1 g + m_2 g) \quad (5)$$

$$\cos \theta_2 (m_2 \ddot{x}_2) = -\sin \theta_2 (m_2 \ddot{y}_2 + m_2 g) \quad (6)$$

$$\ddot{\theta}_1 = \frac{-g(2m_1 + m_2) \sin \theta_1 - m_2 g \sin(\theta_1 - 2\theta_2) - 2 \sin(\theta_1 - \theta_2) m_2 (\dot{\theta}_2^2 L_2 + \dot{\theta}_1^2 L_1 \cos(\theta_1 - \theta_2))}{L_1 (2m_1 + m_2 - m_2 \cos(2\theta_1 - 2\theta_2))}$$

$$\ddot{\theta}_2 = \frac{2 \sin(\theta_1 - \theta_2) (\dot{\theta}_1^2 L_1 (m_1 + m_2) + g(m_1 + m_2) \cos \theta_1 + \dot{\theta}_2^2 L_2 m_2 \cos(\theta_1 - \theta_2))}{L_2 (2m_1 + m_2 - m_2 \cos(2\theta_1 - 2\theta_2))}$$