Einfaldur pendúll:

$g = 9.81\, m/s^2$ $\quad \Theta(0), \dot{\Theta}(0)$ eru gefin

g.r.f. að $\sin(\theta) \simeq \theta$ f. lítil horn

1. $\frac{d^2\Theta}{dt^2} + \frac{g}{L}\sin(\Theta) = 0 \Rightarrow \ddot{\Theta} + \frac{g}{L}\sin(\Theta) = 0$

$\bar{\Theta} = \begin{pmatrix} \Theta \\ \dot{\Theta} \end{pmatrix} \quad \bar{\Theta}' = \begin{pmatrix} \dot{\Theta} \\ \ddot{\Theta} \end{pmatrix}$

$\ddot{\Theta} + \frac{g}{L} \cdot \sin(\Theta) = 0 \Rightarrow \Theta = \sin^{-1}\left(\frac{-\ddot{\Theta}}{g} \cdot L\right)$

$\Rightarrow \ddot{\Theta} = -\frac{g}{L} \cdot \sin(\Theta)$

$$F(t, \bar{\Theta}) = \begin{pmatrix} \Theta \\ \dot{\Theta} \end{pmatrix}' = \begin{pmatrix} \dot{\Theta}(t) \\ -\frac{g}{L} \cdot \sin(\Theta) \end{pmatrix} = Z$$

$Z_1 = \Theta(2)$

$Z_2 = -\frac{g}{L} \cdot \sin(\Theta(1))$ $\quad Z \in \mathbb{R}^2$

$$\bar{\Theta}(t) = \bar{\Theta}(t-1) + h\bar{f}(t-1, \theta)$$

$$\begin{pmatrix} \theta(t) \\ \dot{\theta}(t) \end{pmatrix} = \begin{pmatrix} \theta(t-1) \\ \dot{\theta}(t-1) \end{pmatrix} + h \begin{pmatrix} \dot{\theta}(t-1) \\ (-g/L) \cdot \sin(\theta(t-1)) \end{pmatrix}$$

Tvöfaldur pendúll:

$$\frac{d^2\theta_1}{dt^2} = \frac{m_2 L_1 \omega_1^2 \sin(\Delta)\cos(\Delta) + m_2 g \sin(\theta_2)\cos(\Delta) + m_2 L_2 \omega_2^2 \sin(\Delta) - (m_1+m_2) g \sin(\theta_1)}{(m_1+m_2)L_1 - m_2 L_1 \cos^2(\Delta)} = \ddot{\theta}_1$$

$$\frac{d^2\theta_2}{dt^2} = \frac{-m_2 L_2 \omega_2^2 \sin(\Delta)\cos(\Delta) + (m_1+m_2)\big(g\sin(\theta_1)\cos(\Delta) - L_1\omega_1^2 \sin(\Delta) - g\sin(\theta_2)\big)}{(m_1+m_2)L_2 - m_2 L_2 \cos^2(\Delta)} = \ddot{\theta}_2$$

þar sem $\Delta = \theta_2 - \theta_1$, $\omega_1 = \theta_1'$ og $\omega_2 = \theta_2'$.

$$\bar{F}(t, \bar{\theta}_1, \bar{\theta}_2) = \begin{pmatrix} \theta_1 \\ \theta_1' \\ \theta_2 \\ \theta_2' \end{pmatrix}' = \begin{pmatrix} \theta_1' \\ \theta_1'' \\ \theta_2' \\ \theta_2'' \end{pmatrix}$$

$$\bar{F}(t, \bar{\theta}_1, \bar{\theta}_2) = \begin{pmatrix} \omega_1 \\ \frac{m_2 L_1 \omega_1^2 \sin(\Delta)\cos(\Delta) + m_2 g \sin(\theta_2)\cos(\Delta) + m_2 L_2 \omega_2^2 \sin(\Delta) - (m_1+m_2) g \sin(\theta_1)}{(m_1+m_2)L_1 - m_2 L_1 \cos^2(\Delta)} \\ \omega_2 \\ \frac{-m_2 L_2 \omega_2^2 \sin(\Delta)\cos(\Delta) + (m_1+m_2)\big(g\sin(\theta_1)\cos(\Delta) - L_1\omega_1^2 \sin(\Delta) - g\sin(\theta_2)\big)}{(m_1+m_2)L_2 - m_2 L_2 \cos^2(\Delta)} \end{pmatrix} = Z$$

$$Z \in \mathbb{R}^4$$

$$Z_1 = \theta_1(2)$$

$$\begin{aligned} Z_2 = \big(&m_2 L_1 (\theta_1(2))^2 \sin(\theta_2(1) - \theta_1(1)) \cos(\theta_2(1) - \theta_1(1)) \\ &+ m_2\, g \sin(\theta_2(1)) \cos(\theta_2(1) - \theta_1(1)) \\ &+ m_2 \cdot L_2\, \theta_2(2)^2 \cdot \sin(\theta_2(1) - \theta_1(1)) \\ &- (m_1 + m_2) \cdot g \cdot \sin(\theta_1(1))\big) \\ &/\big((m_1+m_2) \cdot L_1 - m_2 L_1 \cos^2(\theta_2(1) - \theta_1(1))\big) \end{aligned}$$

$$Z_3 = \theta_2(2)$$

$$Z_4 = (-m_2 L_2 (\theta_2(2))^2 \sin(\theta_2(1) - \theta_1(1)) \cos(\theta_2(1) - \theta_1(1))$$

$$+ (m_1 + m_2)(g \sin(\theta_1(1)) \cdot \cos(\theta_2(1) - \theta_1(1))$$

$$- L_1 \theta_1(2)^2 \cdot \sin(\theta_2(1) - \theta_1(1))$$

$$- g \cdot \sin(\theta_2(1)))$$

$$/((m_1 + m_2) \cdot L_2 - m_2 L_2 \cos^2(\theta_2(1) - \theta_1(1)))$$