$$\dot{\mathbf{x}} = \begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \\ \dot{x}_4 \end{bmatrix} = \begin{bmatrix} x_2 \\ f_1(x_1, x_2, x_3, x_4) \\ x_4 \\ f_2(x_1, x_2, x_3, x_4) \end{bmatrix}$$

$$\mathbf{y} = \begin{bmatrix} x_1 \\ x_3 \end{bmatrix}$$

Let $\Delta = x_3 - x_1$:

$$f_1(x) = -\frac{g}{\ell_1}\sin(x_1) + \frac{k}{m_1\ell_1^2}\Delta$$

$$f_2(x) = -\frac{g}{\ell_2}\sin(x_3) - \frac{k}{m_2\ell_2^2}\Delta$$