Problem 26   (Computing Jacobians)

(a) $\vec{x} = f(\vec{q}) = \begin{bmatrix} (l_2 + l_3 \sin\varphi)\sin\beta \\ l_1 - l_3 \cos\varphi \\ (l_2 + l_3 \sin\varphi)\cos\beta \end{bmatrix}$

(b) $\mathbf{J}_f = \dfrac{\partial f}{\partial q} = \begin{bmatrix} (l_2 + l_3 \sin\varphi)\cos\beta & l_3 \cos\varphi \sin\beta \\ 0 & l_3 \sin\varphi \\ -(l_2 + l_3 \sin\varphi)\sin\beta & l_3 \cos\varphi \cos\beta \end{bmatrix}$

(c)

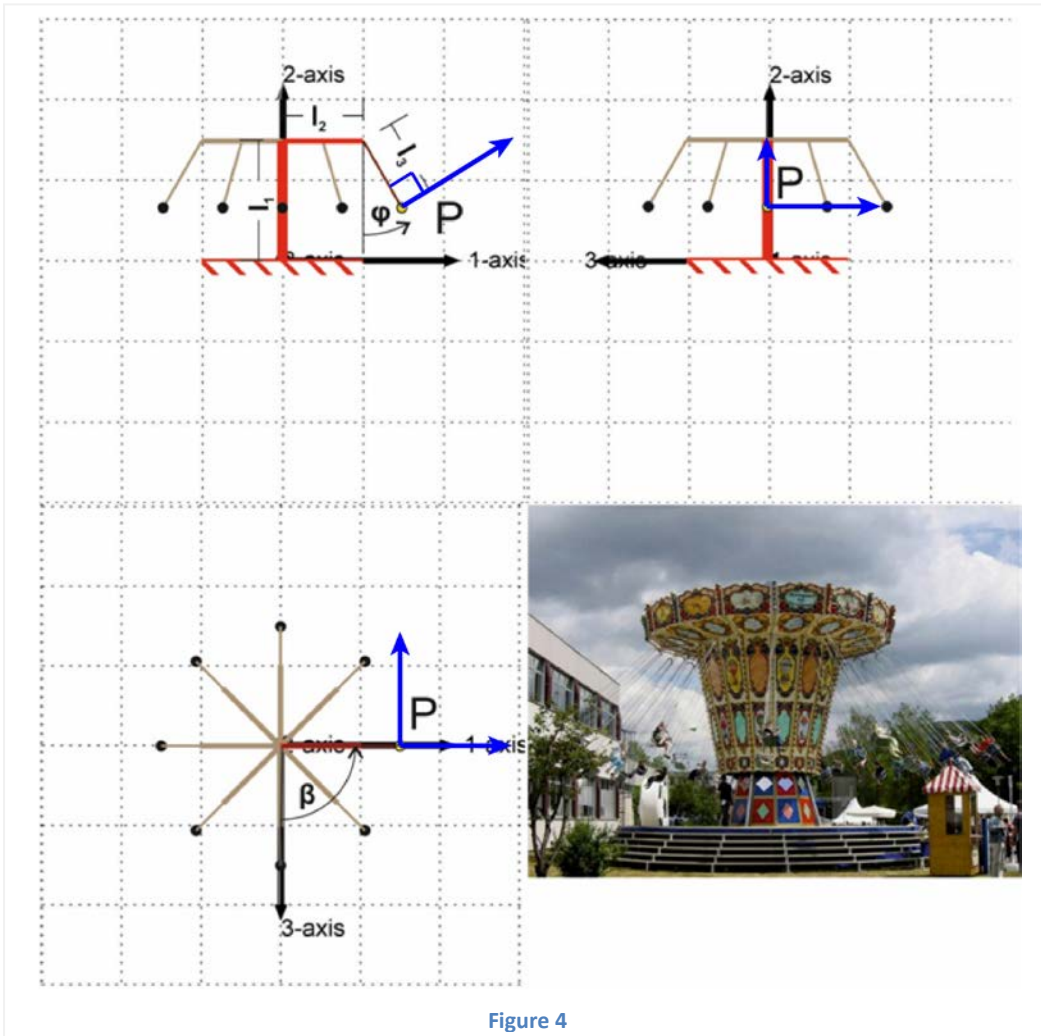Figure 4