· To obtain $f(z|x)$ we use a change of variables over $w(k)$ through the nonlinear function $h(x,w)$ where:

$$z(k) = p(k) = \begin{bmatrix} x(t_k) + \frac{1}{2}B\cos(\theta(t_k)) + w_1 \\ y(t_k) + \frac{1}{2}B\sin(\theta(t_k)) + w_2 \end{bmatrix}$$

· Assume that x and w are intependent (or calibrated to be so)

→ Use change of variables

$$f(z|x) = f_{w|x}(h(z,x)|x)\left|\det\left(\frac{\partial g}{\partial w}(x, h(z,x))\right)\right|^{-1}$$

· We first find $h(z,x)$ from solving $z = g(x,w)$ for w

· $w(k) = p(k) - \begin{bmatrix} x(t_k) + \frac{1}{2}B\cos(\theta(t_k)) \\ y(t_k) + \frac{1}{2}B\sin(\theta(t_k)) \end{bmatrix} = h(z,x)$

· $\frac{\partial g}{\partial w} = \text{jacobian}(p(k)) = \text{jacobian}\left(\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} w_1 \\ w_2 \end{bmatrix}\right) = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = G$

· In this specific case, $|\det(G)|^{-1} = 1$

$\therefore f(z|x) = f_{w|x}(h(z,x)|x) = f_w(h(z,x))$ since x & w indep