

Intersection Computation

$$\begin{aligned}\begin{bmatrix} x \\ y \end{bmatrix} &= \alpha \begin{bmatrix} x_1 \\ y_1 \end{bmatrix} + (1 - \alpha) \begin{bmatrix} x_2 \\ y_2 \end{bmatrix} \\ \begin{bmatrix} x \\ y \end{bmatrix} &= \begin{bmatrix} x_0 \\ y_0 \end{bmatrix} + \beta \begin{bmatrix} \cos \phi \\ \sin \phi \end{bmatrix} \\ \begin{bmatrix} x_1 - x_2 & -\cos \phi \\ y_1 - y_2 & -\sin \phi \end{bmatrix} \begin{bmatrix} \alpha \\ \beta \end{bmatrix} &= \begin{bmatrix} x_0 - x_2 \\ y_0 - y_2 \end{bmatrix} \\ \begin{bmatrix} \alpha \\ \beta \end{bmatrix} &= \begin{bmatrix} \frac{-\sin \phi (x_0 - x_2) + \cos \phi (y_0 - y_2)}{(x_2 - x_1) \sin \phi + (y_1 - y_2) \cos \phi} \\ \frac{(y_2 - y_1)(x_0 - x_2) + (x_1 - x_2)(y_0 - y_2)}{(x_2 - x_1) \sin \phi + (y_1 - y_2) \cos \phi} \end{bmatrix}\end{aligned}$$

Noise Sampling

$$\begin{aligned}w &= 2\epsilon - \sqrt{4\epsilon^2 - 5\epsilon^2 F(w)} \quad (F(w) \leq 0.8) \\ w &= 2\epsilon + \sqrt{\frac{5\epsilon^2 F(w) - 4\epsilon^2}{2}} \quad (0.8 < F(w) \leq 0.9) \\ w &= 3\epsilon - \sqrt{\frac{5\epsilon^2 - 5\epsilon^2 F(w)}{2}} \quad (0.9 < F(w) \leq 0.1)\end{aligned}$$

Measurement Update

$$p_{z(k)|x(k)}(\bar{z}(k)|\bar{x}_p(k)) = p_w(\bar{z}(k) - \bar{x}_p(k))$$