

$$y_i = \begin{bmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix} \begin{bmatrix} x_f - x_r \\ y_f - y_r \end{bmatrix}$$

$$\begin{aligned} & x_f \cos \theta - x_r \cos \theta - y_f \sin \theta + y_r \sin \theta \\ & x_f \sin \theta - x_r \sin \theta + y_f \cos \theta - y_r \cos \theta \end{aligned}$$