Inverse Kinematics $\longrightarrow$ Forward Kinematics

IK $$\begin{bmatrix} \dot{\phi}_1 \\ \dot{\phi}_2 \end{bmatrix} = \frac{1}{r}\begin{bmatrix} -D & 1 & 0 \\ D & 1 & 0 \end{bmatrix}\begin{bmatrix} \dot{\theta} \\ v_x \\ v_y \end{bmatrix}$$

$$\dot{\phi}_1 = -\frac{D}{r}\dot{\theta} + \frac{v_x}{r}$$

$$\dot{\phi}_2 = \frac{D}{r}\dot{\theta} + \frac{v_x}{r}$$

$$\dot{\phi}_1 + \dot{\phi}_2 = \frac{2v_x}{r}$$

$$\boxed{v_x = \frac{r(\dot{\phi}_1 + \dot{\phi}_2)}{2}}$$

Substituting v_x:

$$\dot{\phi}_2 = \frac{D}{r}\dot{\theta} + \frac{1}{\cancel{r}}\left(\frac{\cancel{r}(\dot{\phi}_1 + \dot{\phi}_2)}{2}\right)$$

$$\dot{\phi}_2 = \frac{D}{r}\dot{\theta} + \frac{\dot{\phi}_1 + \dot{\phi}_2}{2}$$

$$\frac{D}{r}\dot{\theta} = \dot{\phi}_2 - \frac{\dot{\phi}_1 + \dot{\phi}_2}{2}$$

FK

$$\boxed{\dot{\theta} = \frac{r}{2D}\left(\dot{\phi}_2 - \dot{\phi}_1\right)}$$

ϕ_1 = left wheel

ϕ_2 = right wheel