$$e^{[S]\theta} = \begin{bmatrix} e^{[w]\theta} & I\theta + (1-\cos\theta)[w] + (\theta - \sin\theta)[w^2] v \\ 0 & 1 \end{bmatrix}$$

$w = \frac{w}{theta}$ $\quad theta = \sqrt{mag}$.

$$e^{[w]\theta} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} + \sin(theta)[\hat{\omega}] + (1-\cos\theta)[\hat{\omega}]^2$$

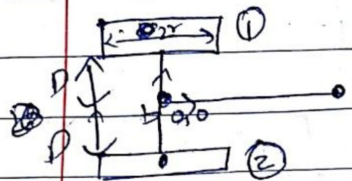
$$w = \begin{bmatrix} 0 \\ 0 \\ w_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \quad \theta = w_2.$$

$$[\hat{\omega}] = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$e^{[w]\theta} = I + \sin(w_2) \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} + 1-\cos(w) \times \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \times w_3 + (1-\cos(w_3)) \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} + w_3 - \sin(w_3) \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 0 \end{bmatrix} \times \begin{bmatrix} \frac{v}{w} \\ \frac{v}{w} \\ 0 \end{bmatrix}$$

$$e^{k|0} = \begin{vmatrix} \cos(w_2) & -\sin(w_2) & \frac{V_x \sin(w_3)}{w_3} - \frac{V_y}{w_3} + V_y \frac{\cos(w_3)}{w_3} \\ \sin(w_2) & \cos(w_2) & \frac{V_x}{w_3} - \frac{V_x \cos(w_3)}{w_3} + \frac{V_y}{w} \sin(w_3) \\ 0 & 0 & 1 \end{vmatrix}$$



$T_{b1}(0, 0, D)$ $\quad A_{b1} = \begin{vmatrix} 1 & 0 & 0 \\ D & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix}$

$T_{b2}(0, 0, -D)$

$$A_{1b} = \begin{vmatrix} 1 & 0 & 0 \\ -D & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix} \qquad A_{b2} = \begin{vmatrix} 1 & 0 & 0 \\ -D & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix}$$

$$A_{2b} = \begin{vmatrix} 1 & 0 & 0 \\ D & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix}$$

$V_1 = A_{1b} V_b \quad V_2 = A_{2b} V_b.$ $\quad V_b = \begin{vmatrix} \dot\theta \\ V_x \\ V_y \end{vmatrix}$

$$V_1 = \begin{vmatrix} \dot\theta \\ V_{x1} \\ V_{y1} \end{vmatrix} \quad \begin{vmatrix} \dot\theta \\ r U_1 \\ 0 \end{vmatrix} = \begin{vmatrix} 1 & 0 & 0 \\ -D & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix} \times \begin{vmatrix} \dot\theta \\ V_x \\ V_y \end{vmatrix}$$

$$\begin{vmatrix} \dot{\theta} \\ r v_1 \\ 0 \end{vmatrix} = \begin{vmatrix} \dot{\theta} \\ \cancel{D V_x +} \; -D\dot{\theta} + V_x \\ v_y \end{vmatrix}$$

$$v_1 = -\frac{D\dot{\theta}}{r} + \frac{V_x}{r}$$

$$\begin{bmatrix} v_1 \\ 0 \end{bmatrix} = \begin{bmatrix} -\frac{D}{r} & \frac{1}{r} & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \dot{\theta} \\ V_x \\ v_y \end{bmatrix}$$

$$\begin{bmatrix} v_2 \\ 0 \end{bmatrix} = \begin{bmatrix} D/r & 1/r & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \dot{\theta} \\ V_x \\ v_y \end{bmatrix}$$

$$\begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \frac{1}{r} \begin{bmatrix} -D & 1 & 0 \\ D & 1 & 0 \end{bmatrix} \begin{bmatrix} \dot{\theta} \\ v_x \\ v_y \end{bmatrix}$$