$$T_{b,r} = (0,0,0) \qquad V_b = \begin{bmatrix} \dot{0} \\ \dot{x} \\ \dot{y} \end{bmatrix} \qquad \begin{bmatrix} v_x \\ v_y \end{bmatrix} = \begin{bmatrix} r \phi \\ 0 \end{bmatrix}$$

$$T_{b,r} = (0,0,-D)$$

$$\begin{bmatrix} v_y \\ v_y \end{bmatrix} = \begin{bmatrix} r & \phi \\ 0 \end{bmatrix}$$

$$A_{b1} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$A_{bi} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \qquad A_{ib} = \begin{bmatrix} 1 & 0 & 0 \\ -0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$A_{br} = \begin{bmatrix} 1 & 0 & 0 \\ -D & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \qquad A_{rb} = \begin{bmatrix} 1 & 0 & 0 \\ D & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$V_{i} = A_{ib} V_{b} = \begin{bmatrix} 1 & 0 & 0 \\ -0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \dot{0} \\ \dot{x} \\ \dot{y} \end{bmatrix} = \begin{bmatrix} \dot{0} \\ -D\dot{0} + \dot{x} \\ \dot{y} \end{bmatrix} \longrightarrow \begin{bmatrix} \dot{0} \\ r\dot{0} \\ 0 \end{bmatrix} = \begin{bmatrix} \dot{0} \\ -D\dot{0} + \dot{x} \\ \dot{y} \end{bmatrix} \longrightarrow \dot{0} = -\frac{D\dot{0} + \dot{x}}{r}$$

$$V_{r} = A_{rb} V_{b} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \dot{0} \\ \dot{x} \\ \dot{y} \end{bmatrix} = \begin{bmatrix} \dot{0} \\ \dot{D}\dot{0} + \dot{x} \\ \dot{y} \end{bmatrix} \longrightarrow \begin{bmatrix} \dot{0} \\ \dot{r}\dot{b} \\ 0 \end{bmatrix} = \begin{bmatrix} \dot{0} \\ \dot{D}\dot{0} + \dot{x} \\ \dot{y} \end{bmatrix} \longrightarrow \dot{b} = \underbrace{\begin{array}{c} \dot{0} \\ \dot{D}\dot{0} + \dot{x} \\ \dot{y} \end{array}} \longrightarrow \dot{b} = \underbrace{\begin{array}{c} \dot{0} \\ \dot{D}\dot{0} + \dot{x} \\ \dot{y} \end{array}}$$

$$\begin{bmatrix} u_1 \\ u_n \end{bmatrix} = \frac{1}{\Gamma} \begin{bmatrix} -D & 1 & 0 \\ D & 1 & 0 \end{bmatrix} \begin{bmatrix} \dot{0} \\ \dot{x} \\ \dot{\gamma} \end{bmatrix} = \begin{bmatrix} \frac{-D\dot{0} + \dot{x}}{\Gamma} \\ \frac{D\dot{0} + \dot{x}}{\Gamma} \end{bmatrix}$$

$$U_{1} = \frac{D\dot{O} + \dot{x}}{r} \rightarrow ru_{1} + D\dot{O} = \dot{x} \rightarrow \dot{x} = ru_{1} + D\left(\frac{ru_{1} - ru_{1}}{2D}\right) \rightarrow \dot{x} = \frac{ru_{1} + ru_{1}}{2}$$

$$u_r = \frac{D\dot{O} + \dot{x}}{\dot{r}} \rightarrow u_r = \frac{D\dot{O} + ru_1 + D\dot{O}}{\dot{r}} \rightarrow \frac{\dot{O} = \frac{ru_r - ru_1}{2D}}{2D}$$

$$H_{+} = \frac{5}{L} \begin{bmatrix} 0 & 0 \\ -\frac{1}{1} & \frac{1}{1} \\ 0 & 0 \end{bmatrix}$$

$$V_b = H^{\dagger}u$$

$$V_{b} = H^{\dagger}u$$

$$\begin{bmatrix} \dot{o} \\ \dot{x} \\ \dot{y} \end{bmatrix} = \frac{\Gamma}{2} \begin{bmatrix} -\frac{1}{D} & \frac{1}{D} \\ 1 & 0 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} u_{1} \\ u_{r} \end{bmatrix} = \begin{bmatrix} \frac{ru_{r} - ru_{1}}{2D} \\ \frac{ru_{r} + ru_{1}}{2} \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} \Delta O \\ \Delta X \\ \Delta Y \end{bmatrix} = \begin{bmatrix} 1 & O & O \\ O & \cos O & -\sin O \\ O & \sin O & \cos O \end{bmatrix} \begin{bmatrix} \Delta O_b \\ \Delta X_b \\ \Delta Y_b \end{bmatrix} = \begin{bmatrix} \Delta O_b \\ \Delta X_b & \cos O - \Delta Y_b & \sin O \\ \Delta X_b & \sin O + \Delta Y_b & \cos O \end{bmatrix}$$