



- A → Contact between screw and body (Pivot)
 B → Contact between screw and sleeve (Helical)
 C → Contact between sleeve and body (Helical)
 2 → body 3, 45 → screw 30 → Sleeve
 B → surface internal of sleeve
 C → surface ext. of sleeve
 P_1 → Pitch at B. on sleeve (int)
 P_2 → Pitch at C. on sleeve (ext)

$$T_{45/2} = \begin{Bmatrix} \omega_{45/2} & 0 \\ 0 & 0 \\ 0 & 0 \end{Bmatrix}$$

$$T_{30/45} = \begin{Bmatrix} \omega_{30/45} & P_1 \omega_{30/45} \\ 0 & 0 \\ 0 & 0 \end{Bmatrix}$$

$$T_{2/30} = \begin{Bmatrix} \omega_{2/30} & P_2 \omega_{2/30} \\ 0 & 0 \\ 0 & 0 \end{Bmatrix}$$

$$R_x(A) = 0 \rightarrow P_1 \omega_{30/45} + P_2 \omega_{2/30} + 0 = 0$$

$$P_1 \omega_{30/45} = -P_2 \omega_{2/30}$$

$$\omega_{30/2} + \omega_{2/45} = -\omega_{2/30}$$

$$\omega_{30/2} = \omega_{30/45} - \omega_{45/2}$$

$$\text{If } P_1 = P_2 \rightarrow \omega_{30/45} = -\omega_{2/30}$$

$$\text{Hence } \boxed{\omega_{45/2} = 0} \rightarrow \text{Screw blocked / jammed}$$

$$\text{If } P_1 = -P_2 \quad \left[\text{Pitch equal but opposite direction} \right]$$

$$\omega_{30/45} = \omega_{2/30}$$

$$\omega_{30/2} = \omega_{45/2} + \omega_{2/30} = \omega_{45/2} - \omega_{30/45}$$

$$\text{So } 2\omega_{30/2} = \omega_{45/2}$$

$$\rightarrow R_x = P_2 \omega_{2/30} = \frac{P_2}{2} \omega_{45/2} \quad (\text{displacement})$$

$$\text{If } P_1 \neq P_2$$

$$\omega_{30/2} = -\frac{P_1}{P_2} \omega_{45/30}$$

$$= -\frac{P_1}{P_2} (\omega_{45/2} + \omega_{2/30})$$

$$= -\frac{P_1}{P_2} \omega_{45/2} - \frac{P_1}{P_2} \omega_{2/30}$$

$$= -\frac{P_1}{P_2} \omega_{45/2} + \frac{P_1}{P_2} \omega_{30/2}$$

$$\omega_{30/2} \left(1 - \frac{P_1}{P_2} \right) = -\frac{P_1}{P_2} \omega_{45/2}$$

$$R_{x30/2} = P_2 \omega_{30/2}$$

$$= -P_2 \left(1 - \frac{P_1}{P_2} \right) \frac{P_1}{P_2} \omega_{45/2}$$

$$R_{x30/2} \rightarrow \text{axial displacement of sleeve on body 2}$$

$$R_{x30/2} \rightarrow \left(\frac{P_1}{P_2} - 1 \right) \omega_{45/2}$$

To amplify (multiply)

$$R_{x20/2} > R_x$$

$$\frac{P_1}{P_2} \omega_{45/2} > \frac{P_1}{P_2} \omega_{45/2}$$

$$\left(\frac{P_1}{P_2} - 1 \right)$$

$$1 > \frac{P_1}{P_2} - 1$$

$$\boxed{2P_2 > P_1}$$

So if the pitch on internal surface of sleeve is less than two times the pitch on the outer surface; probably !???