ロボット概論　第9回

ベース座標系 Σ_B → [z軸回りに $\frac{\pi}{2}$ rad] → [x軸回りに $\frac{\pi}{2}$ rad] → [x軸方向に 1] → [z軸方向に 1] → ハンド座標系 Σ_{H1}

→ $[{}^B T_{H1}]$

${}^B T_{H1} = Rot(z, \frac{\pi}{2}) Rot(x, \frac{\pi}{2}) Trans(1,0,1)$

問1

$$= \begin{bmatrix} C\theta & -S\theta & 0 & 0 \\ S\theta & C\theta & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & C\theta & -S\theta & 0 \\ 0 & S\theta & C\theta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} C\theta & -S\theta & 0 & 0 \\ S\theta & C\theta & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 1+0+0 \\ 0 & C\theta & -S\theta & 0+(-S\theta)+0 \\ 0 & S\theta & C\theta & 0+C\theta+0 \\ 0 & 0 & 0 & 0+0+1 \end{bmatrix}$$

$$= \begin{bmatrix} C\theta & -S\theta & 0 & 0 \\ S\theta & C\theta & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & C\theta & -S\theta & -S\theta \\ 0 & S\theta & C\theta & C\theta \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} C\theta & (-S\theta)\cdot C\theta + 0 & (-S\theta)^2 + 0 \cdot C\theta & C\theta + (-S\theta)^2 + 0 \\ S\theta & C\theta \cdot C\theta + 0 & C\theta \cdot (-S\theta) + 0 & S\theta + C\theta(-S\theta) + 0 \\ 0 & 0 + S\theta & C\theta & C\theta \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} C\theta & -S\theta C\theta & (S\theta)^2 & C\theta + C(-S\theta)^2 \\ S\theta & (C\theta)^2 & -C\theta \cdot S\theta & S\theta - C\theta \cdot S\theta \\ 0 & S\theta & C\theta & C\theta \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad (C\theta = \frac{\sqrt{2}}{2},\ S\theta = \frac{\sqrt{2}}{2})$$

$$= \begin{bmatrix} \frac{\sqrt{2}}{2} & -\frac{1}{2} & \frac{1}{2} & \frac{\sqrt{2}}{2} + \frac{1}{2} \\ \frac{\sqrt{2}}{2} & \frac{1}{2} & -\frac{1}{2} & \frac{\sqrt{2}}{2} - \frac{1}{2} \\ 0 & \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

問2

$({}^B p) = {}^B T_{H1} ({}^{H1} p)$

$\Rightarrow \begin{bmatrix} {}^B p \\ 1 \end{bmatrix} = {}^B T_{H1} \begin{bmatrix} {}^{H1} p \\ 1 \end{bmatrix}$

よって,

$$= {}^B T_{H1} \begin{bmatrix} {}^{H1} p \\ 1 \end{bmatrix} = \begin{bmatrix} \frac{\sqrt{2}}{2} & -\frac{1}{2} & \frac{1}{2} & \frac{\sqrt{2}}{2} + \frac{1}{2} \\ \frac{\sqrt{2}}{2} & \frac{1}{2} & -\frac{1}{2} & \frac{\sqrt{2}}{2} - \frac{1}{2} \\ 0 & \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} \frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2} + \frac{1}{2} \\ \frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2} - \frac{1}{2} \\ 0 + \frac{\sqrt{2}}{2} \\ 0 + 1 \end{bmatrix} = \begin{bmatrix} \sqrt{2} + \frac{1}{2} \\ \sqrt{2} - \frac{1}{2} \\ \frac{\sqrt{2}}{2} \\ 1 \end{bmatrix}$$

よって ${}^B p = \begin{bmatrix} \sqrt{2} + \frac{1}{2} \\ \sqrt{2} - \frac{1}{2} \\ \frac{\sqrt{2}}{2} \\ 1 \end{bmatrix}$