Autonomous Mobile Robots

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1 Locomotion & Kinematics

1.1 Positioning

D 1.1.1 *(Position Vector)* $\boxed{W}\mathbf{t}\boxed{B} = \boxed{W}\mathbf{t}\boxed{W}\boxed{B}$, Original Frame, End point, Target Frame, $\sin = s$, $\cos = c$

D 1.1.2 *(State vector)* x_R: x, v of rob in W, pos of sensors

D 1.1.3 *(Rot. Mat.)* $\mathbf{R}_z = \begin{bmatrix} c(\psi) & -s(\psi) & 0 \\ s(\psi) & c(\psi) & 0 \\ 0 & 0 & 1 \end{bmatrix}$

$\mathbf{R}_y(\theta) = \begin{bmatrix} c(\psi) & 0 & s(\psi) \\ 0 & 1 & 0 \\ -s(\psi) & 0 & c(\psi) \end{bmatrix}$ $\mathbf{R}_x(\varphi)$ $\begin{bmatrix} 1 & 0 & 0 \\ 0 & c(\psi) & -s(\psi) \\ 0 & s(\psi) & c(\psi) \end{bmatrix}$

R 1.1.4 Application: ${}_W\mathbf{a} = \mathbf{R}_{WB\,B}\mathbf{a}$

L 1.1.5 $\mathbf{R}_{BW} = \mathbf{R}_{WB}^{-1} = \mathbf{R}_{WB}^{\top}$, $\det(\mathbf{R}_{WB}) = 1$ (orth.)

R 1.1.6 Cols of $\mathbf{R}_{WB}$ are basis vec. of Frame $\underset{\rightarrow}{\mathcal{F}}_B$ in $\underset{\rightarrow}{\mathcal{F}}_W$

D 1.1.7 *(Euler Angles)* Yaw (z), Pitch (y), Roll (x), mult. rotation matrices, e.g. $\mathbf{R}_{EB} = \mathbf{R}_z(\psi) \cdot \mathbf{R}_y(\theta) \cdot \mathbf{R}_x(\varphi)$, bound.