RaiSim Cheatsheet- Articulated system

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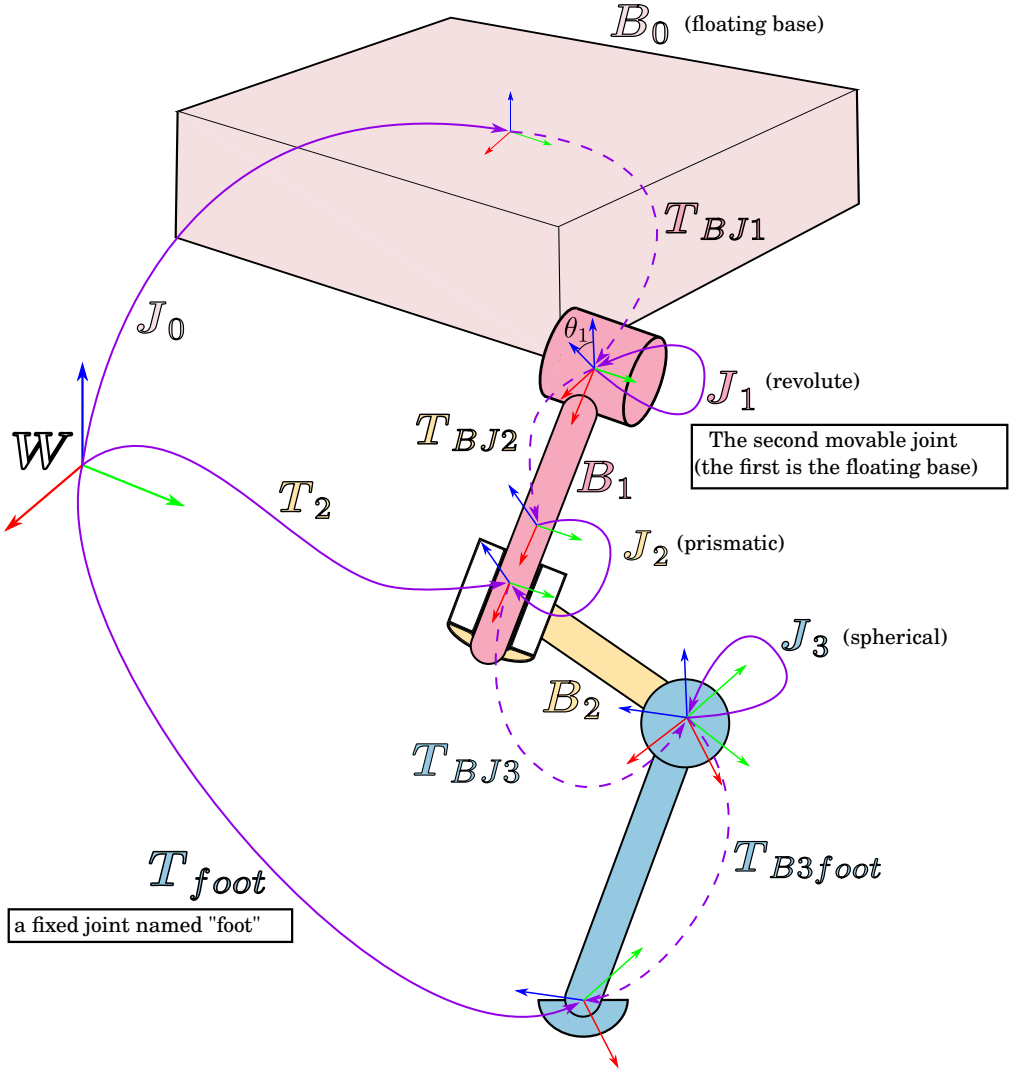
Legend

- Varying transformation (a function of the generalized coordinate)
- Constant transformation (independent of the generalized coordinate)

floating-base system



Joint state representation

$\mathbb{J}_0$: $\psi_0 = r_0, q_0$ (Base position and quaternion)

$u_0 = v_0, \omega_0^{\mathbb{W}}$

[angular velocity defined in the world frame!!!]

$\mathbb{J}_1$: $\psi_1 = \theta_1$, $u_1 = \dot{\theta}_1$

$\mathbb{J}_2$: $\psi_2 = d_2$, $u_2 = \dot{d}_2$

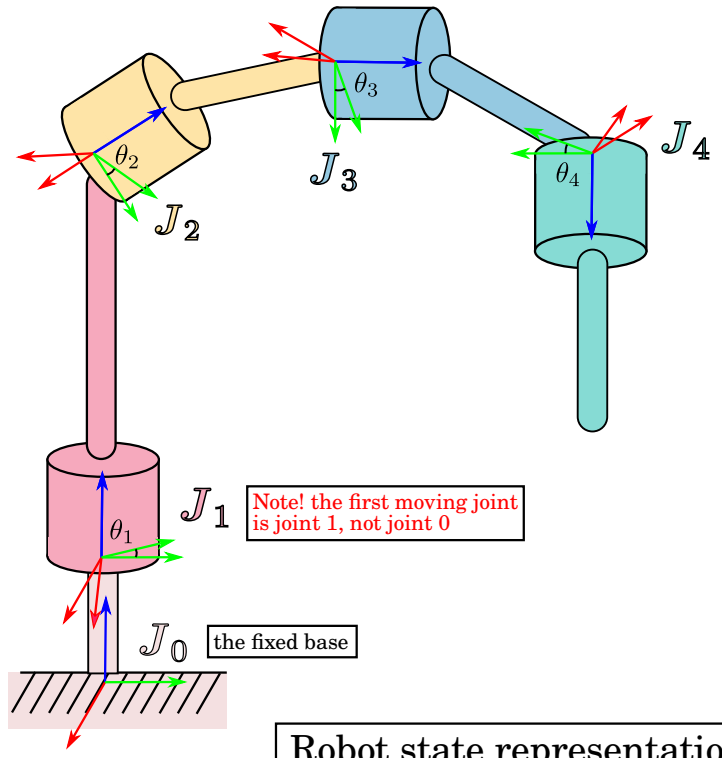
$\mathbb{J}_3$: $\psi_3 = q_3$ (joint rotation relative to the parent, expressed in quaternion)

$u_3 = \omega_3$ (angular velocity relative to the parent)

Robot state representation

$$\boldsymbol{\psi} = [r_0, q_0, \theta_1, d_2, q_3]^T$$
$$\boldsymbol{u} = [v_0, \omega_0, \dot{\theta}_1, v_2, \omega_3]^T$$

fixed-base system



Robot state representation

$$\boldsymbol{\psi} = [\theta_1, \theta_2, \theta_3, \theta_4]$$
$$\boldsymbol{u} = [\dot{\theta}_1, \dot{\theta}_2, \dot{\theta}_3, \dot{\theta}_4]$$

How to get ?		and its derivatives	associated jacobians
$\mathbb{T}_{foot}$	getFramePosition("foot", position_ref) getFrameOrientation("foot", rotation_matrix_ref)	getFrameVelocity("foot", velocity_ref) getFrameAngularVelocity("foot", ang_vel_ref)	getDenseFrameJacobian("foot", jaco_ref) getDenseFrameRotationalJacobian("foot", jaco_ref)
$\mathbb{T}_2$	getPosition(2, position_ref) getOrientation(2, rotation_matrix_ref)	getFrameVelocity(2, velocity_ref) getFrameAngularVelocity(2, ang_vel_ref)	Call these methods with the joint name. All joints are converted to frames
$\mathbb{B}_1$	Body doesn't have a frame of its own (by URDF convention). It is attached to a joint frame		
$\boldsymbol{\psi}$	getGeneralizedCoordinate()		
$\boldsymbol{u}$	getGeneralizedVelocity()		