RaiSim Cheatsheet: Articulated system

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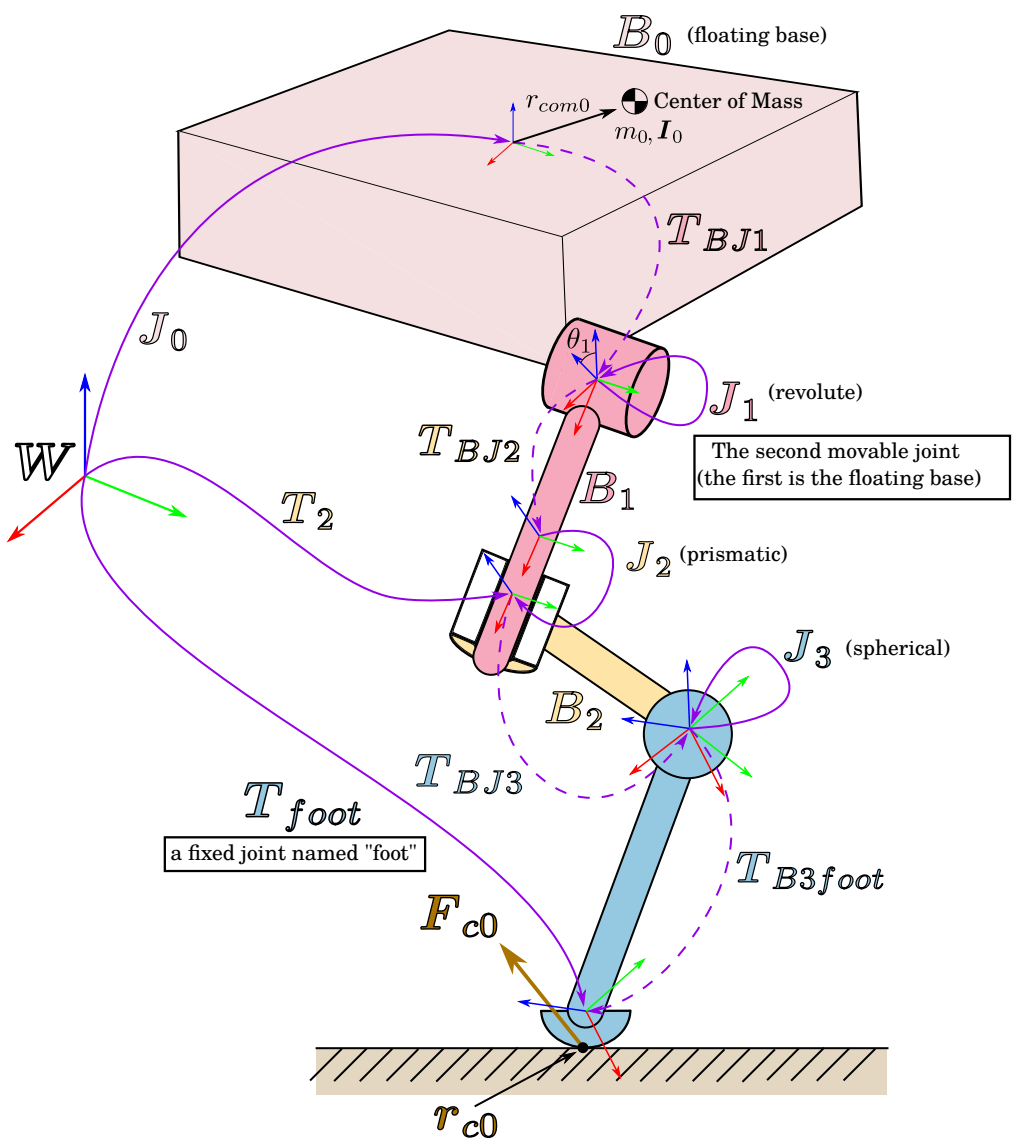
Legend

- 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!!!]

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

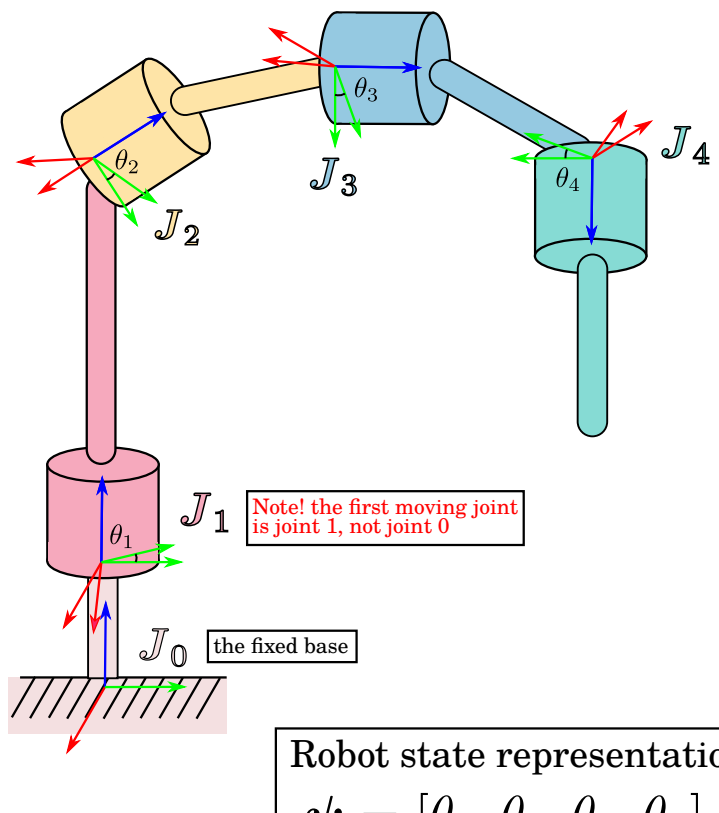
$\mathbb{J}_2$
$\psi_2 = d_2$
$u_2 = \dot{d}_2$

$\mathbb{J}_3$
$\psi_3 = q_3$ 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 ?

Transformations

		its derivatives	associated jacobians
$\mathbb{T}_{foot}$	getFramePosition("foot", position_ref)	getFrameVelocity("foot", velocity_ref)	getDenseFrameJacobian("foot", jaco_ref)
	getFrameOrientation("foot", rotation_matrix_ref)	getFrameAngularVelocity("foot", ang_vel_ref)	getDenseFrameRotationalJacobian("foot", jaco_ref)
$\mathbb{T}_2$	getPosition(2, position_ref)	getFrameVelocity(2, velocity_ref)	
	getOrientation(2, rotation_matrix_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 the URDF convention). It is attached to the associated joint frame

Robot definition (non-const ref's)

$\mathbb{T}_{BJ2}$	getJointPos_P()	r_{com0}	getLinkCOM()
	getJointAxis_P()	m_0	getMass()
	getJointOrientation_P()	$\boldsymbol{I}_0$	getInertia()

Robot state

$\boldsymbol{\psi}$	getGeneralizedCoordinate()
$\boldsymbol{u}$	getGeneralizedVelocity()

Contacts (identical to single body methods)

$\boldsymbol{F}_{c0}$	getContacts()[0].impulse
$\boldsymbol{r}_{c0}$	