NICO - Joint Convention - Last updated: 17.Feb 2016

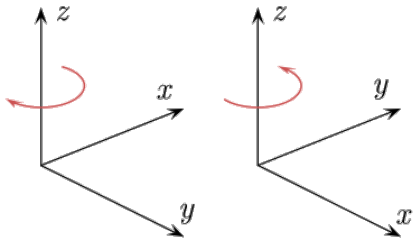
1. **"Intrinsic"** - Positive orientation: the resulting position of a link is closer to NICO's front torso (as in zero position and orientation)

2. **"Right hand rule"** - Example of a robot (see [here]): "(..) all joint displacements are given as relative motions and the right hand rule convention determines the direction of positive rotations." – Also: Right hand rule is for example used in the popular Denavit Hartenberg Convention

Definition "Right hand rule": Wikipedia

Used when vector must be defined to represent the rotation of a body. "When gripping the imaginary axis of rotation of the rotational force so that your fingers point in the direction of the force, the extended thumb points in the direction of the torque vector."

Difference between **left-hand-rule** and right-hand-rule :



→ **Convention used : "intrinsic"** (if not clear as for "head_z": right hand rule)

Upper part:

Joint name	Simulation	URDF	Real	JSON	Should be
head_z	Right-handed		Right-handed	direct	Right-handed
head_y	Right-handed		Right-handed	indirect	Right-handed
r_shoulder_z	Right-handed		Right-handed	direct	Right-handed
r_shoulder_y	Left-handed	-1	Left-handed	direct	Left-handed
r_arm_x	Right-handed		Right-handed	indirect	Right-handed
r_elbow_y	Left-handed	-1	Left-handed	indirect	Left-handed
r_wrist_z	Right-handed		Right-handed	indirect	Right-handed
r_gripper_x	Right-handed		Right-handed	indirect	Right-handed
l_shoulder_z	Left-handed	-1	Left-handed	indirect	Left-handed
l_shoulder_y	Left-handed	-1	Left-handed	indirect	Left-handed
l_arm_x	Left-handed	-1	Left-handed	direct	Left-handed
l_elbow_y	Left-handed	-1	Left-handed	direct	Left-handed
l_wrist_z	Left-handed	-1	Left-handed	direct	Left-handed
l_gripper_x	Left-handed	-1	Left-handed	direct	Left-handed

Lower_part:

Joint name	Simulation	URDF	Real	JSON	Should be
r_hip_z	Right-handed		Right-handed	indirect	Right-handed
r_hip_y	Left-handed	-1	Left-handed	direct	Left-handed
r_hip_x	Right-handed		Right-handed	direct	Right-handed
r_knee_y	Left-handed	-1	Left-handed	direct	Left-handed
r_ankle_y	Left-handed	-1	Left-handed	indirect	Left-handed
r_ankle_x	Right-handed		Right-handed	indirect	Right-handed
l_hip_z	Left-handed	-1	Left-handed	direct	Left-handed
l_hip_y	Left-handed	-1	Not checked	direct	Left-handed
l_hip_x	Left-handed	-1	Not checked	direct	Left-handed
l_knee_y	Left-handed	-1	Not checked	indirect	Left-handed
l_ankle_y	Left-handed	-1	Not checked	direct	Left-handed
l_ankle_x	Left-handed	-1	Not checked	direct	Left-handed

Notes:

- To enable “symmetric” orientation convention:
  - rotation around y: both same handed
  - rotation around x or z: one left- the other one right handed

- **VREP TROUBLES:**
  - Importing correct joint orientation via the URDF
  - See also here: http://www.forum.coppeliarobotics.com/viewtopic.php?f=5&t=1969

  - Problem:
    When importing the URDF all joints, that rotate around the z axis are all RIGHT-Handed, this means following joints are different: l_shoulder_z , l_wrist_z , l_hip_z