Let be the quaternion transforming from Olivier's controller frame (C) to the motion controller frame (M).

Notes

* since this is a rotation, this quaternion is self-inverse, and we simply call it q.
* The quaternion is presented here unnormalized, for avoiding may . In example
* Intuition: This quaternion swaps x and y, and inverts the z axis.

Internally, the reference of the robot is when its body is aligned to its world "x" axis.

The interface between (M) and (C) assumes, however, that the in the reference posture for (M) the robot is aligned with "y", making the reference posture similar for (M) and for (C).

This makes the (M) (C) transformation very simples

Suppose at (C) the robot made a rotation about the mutual reference

Suppose at (M) the robot made a rotation about the mutual reference

Immediately

Let denote the robot's rotation with respect to its original local-x aligned reference; then

Explanation:

* The quaternion is from the y-aligned reference to the present orientation.
* The quaternion is from the x-aligned reference to the present orientation.
* Thus is "rotate the robot as to align with the mutual reference, then rotate from there to present orientation" which is the left expression; the right expression is obtained by right multiplication in y🡺x rotation.