Tutorial 3 – Modeling of the TMS robot

This tutorial deals with the modeling of the TMS robot, introduced and parameterized previously.

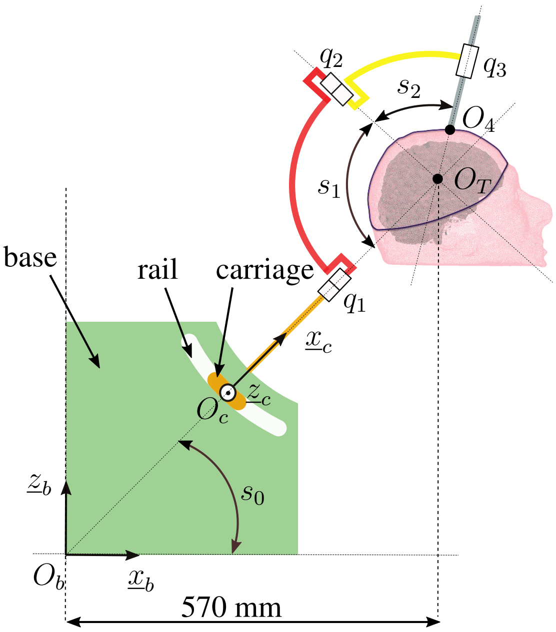

Figure 5: Supporting structure in a planar (sagittal) configuration.

Questions

1 How would you define the Forward Kinematic Model (FKM)?

2 Multiply the transformation matrices properly in order to obtain the position ${}^0\xi = (x \;\; y \;\; z)^T$ of point O_4 in $\mathcal{F}_0$ with a minimal number of operations. To that purpose, you need to know that O_4 is such that the tool tip is just in contact with the 'average' head, when $q_3 = 0$, i.e. $O_3O_4 = r_h$ with $r_h = 120$ mm the 'average' head radius. This is the configuration of the figures until now…

3 Now calculate the position ${}^b\xi$ of point O_4 in $\mathcal{F}_b$ from ${}^0\xi$.

4 Calculate the analytical Inverse Kinematic Model (IKM) to obtain the set of $q = (q_1 \;\; q_2 \;\; q_3)^T$ that correspond a given position ${}^b\xi$. Hint: do solve the FKM equations in $\mathcal{F}_0$!

Tutorial 3, homework – Modeling of the TMS robot

This homework aims at checking Tutorial 3 calculations. **To do it, keep on developing the code from your previous Matlab files.**

Work to be done

In the previous tutorial, we determined the Forward Kinematic Model (FKM) and the Inverse Kinematic Model (IKM).

1 Implement the FKM and take several configurations to check you model validity, e.g. (but not limited to) $s_1 = s_2 = \frac{\pi}{2}$, $q_1 = q_2 = q_3 = 0$ or $q_1 = \frac{\pi}{2}$, $q_2 = -\frac{\pi}{2}$ and $q_3 = 0$.

2 Implement the IKM. To check it is correct, apply successively, from a given random configuration q, the FKM and then the IKM. It should lead to the initial q, plus another one whose validity will be assessed.

There will be no intermediate solution, so persevere!
Post your files to the professor (bernard.bayle@unistra.fr) when it works.