Tutorial 4 – Modeling of the TMS robot, bis

This tutorial deals with the modeling of the robot differential kinematics, which is a prerequisites for the dimensioning of the TMS robot.

Questions

1 Calculate the robot Jacobian matrix, the importance of which is fundamental in the following.

2 Program the Jacobian matrix with the MATLAB files provided by the instructor. The files are now slightly different from the initial ones. The master script is called `design.m`. The different models of the robot have been programmed as separate functions.

3 Since the Jacobian matrix relates the derivatives of the pose x to the derivatives of the configuration q as: $\dot{x} = J(q)\dot{q}$, write enough tests in order to be sure that you have correctly checked the predetermined Jacobian. In particular, it can be interesting to consider simple cases like $q_1 = q_2 = q_3 = 0$ and $s_1 = s_2 = \frac{\pi}{2}$ or alternatively the same configuration with $s_1 = s_2 = \frac{\pi}{4}$ in order to check the computations and programming. Note: work in $\mathcal{F}_0$...

4 Using the spherical representation, compute with MATLAB the positions that cover the hemispheric zone that corresponds to the upper part of the head. Then compute with the IKM the corresponding set of configurations (choose one of the solutions of the IKM, always the same). Fill a table with these x and q values.

Note : the relationship between cartesian coordinates and spherical coordinates is written :

$$x = r \sin\theta \cos\varphi \quad (1)$$

$$y = r \sin\theta \sin\varphi \quad (2)$$

$$z = r \cos\theta \quad (3)$$

with r the radial distance, θ the polar angle, and φ the azimuthal angle (see Figure 6).

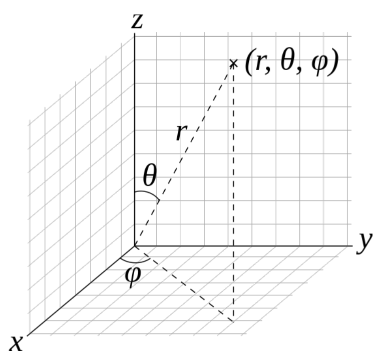

Figure 6: Spherical coordinates [Wikipedia].