Tutorial 5 – Design analysis of the TMS robot

This homework is based on the preliminaries of tutorial 6. It deals with the dimensioning of the TMS robot.

Questions

0 Considering the equality of the mechanical actions work, prove that in quasi static conditions (small motions, slow velocities, no acceleration) the following relationship holds:

$$\tau = J^T f$$

with f the forces and torques applied at the end effector, and τ the joint forces and torques.

1 In every point of this grid, propose a method to compute the joint torques which are necessary to compensate for the weight of the TMS coil. Compute these joint torques:

- for $s_1 = s_2 = \frac{\pi}{2}$
- and then for $s_1 = \frac{2\pi}{3}, s_2 = \frac{\pi}{3}$.

The coil mass is 3 kg.

2 Determine the maximum torque required at each joint for the previous arc lengths.

3 Adapt the codes used in the professor illustration of manipulability, in order to compute the minimum and mean value of the manipulability index w_5 over the same space for the same two sets of parameters:

- for $s_1 = s_2 = \frac{\pi}{2}$
- and then for $s_1 = \frac{\pi}{2}, s_2 = \frac{\pi}{3}$.