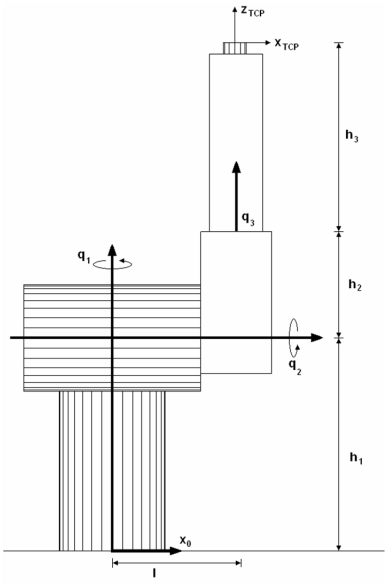
Excercise

Universal transformation



Task 1. ven is the kinematics shown above, a so-called simplified Stanford manipulator. The kinematics consists of two rotatory axes q_1 and q_2 as well as a translational axis q_3.

a) Calculate the Jacobi matrix for the manipulator, based on the forward transformation:

$$
{}^{0}\underline{T}_3 = \begin{bmatrix} C_{q_1} & -S_{q_1}C_{q_2} & S_{q_1}S_{q_2} & lC_{q_1} + (h_2 + h_3 + q_3)\, S_{q_1}S_{q_2} \\ S_{q_1} & C_{q_1}C_{q_2} & -C_{q_1}S_{q_2} & lS_{q_1} - (h_2 + h_3 + q_3)\, C_{q_1}S_{q_2} \\ 0 & S_{q_2} & C_{q_2} & h_1 + (h_2 + h_3 + q_3)\, C_{q_2} \\ 0 & 0 & 0 & 1 \end{bmatrix}
$$

b) Which singularities can be identified using the Jacobi matrix?

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