Activity 3

Problem 2.25

Write the correct sequence of movements that must be made in order to restore the original orientation of the spherical coordinates and make it parallel to the reference frame. About what axes are these rotations supposed to be?

Problem 2.27

Suppose that a robot is made of a Cartesian and RPY combination of joints. Find the necessary RPY angles to achieve the following:

$$T = \begin{bmatrix} 0.527 & -0.574 & 0.628 & 4 \\ 0.369 & 0.819 & 0.439 & 6 \\ -0.766 & 0 & 0.643 & 9 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Problem 2.33

Frames describing the base of a robot and an object are given relative to the Universe frame.

- Find a transformation ${}^{R}T_{H}$ of the robot configuration if the hand of the robot is to be placed on the object.

$${}^{U}T_{obj} = \begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 0 & -1 & 3 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \qquad {}^{U}T_{R} = \begin{bmatrix} 0 & -1 & 0 & -2 \\ 1 & 0 & 0 & 5 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Problem 2.34

Frames describing the base of a robot and an object are given relative to the Universe frame.

- Find a transformation ${}^{R}T_{H}$ of the robot configuration if the hand of the robot is to be placed on the object.
- Assuming that the robot is a 6-axis robot with Cartesian and RPY coordinates, find $p_x, p_y, p_z, \phi_a, \phi_o, \phi_n$.

$${}^{U}T_{obj} = \begin{bmatrix} 0 & 0.707 & -0.707 & 0 \\ -0.866 & -0.3535 & -0.3535 & 0 \\ -0.5 & 0.6123 & 0.6123 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \qquad {}^{U}T_{R} = \begin{bmatrix} 1 & 0 & 0 & 3 \\ 0 & 1 & 0 & 6 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$