تمرین سری اول رباتیک پیشرفته (مباحث فصل دوم)

پاسخ تمرین از طریق سامانه LMS ارسال شود.

1- Consider the following sequence of rotations:

(a) Rotate by 90° about the world x-axis.

(b) Rotate by -60° about the current z-axis.

(c) Rotate by 45° about the world y-axis.

Write the matrix product that will give the resulting rotation matrix.

2- Suppose that three coordinate frames $o_1x_1y_1z_1$, $o_2x_2y_2z_2$ and $o_3x_3y_3z_3$ are given, and suppose

$$R_2^1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \frac{1}{2} & -\frac{\sqrt{3}}{2} \\ 0 & \frac{\sqrt{3}}{2} & \frac{1}{2} \end{bmatrix}; R_3^1 = \begin{bmatrix} 0 & 0 & -1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$$

Find the matrix ${R_3}^2$.

3- Suppose R represents a rotation of 90° about y_0 followed by a rotation of 45° about z_1. Find the equivalent axis/angle to represent R. Sketch the initial and final frames and the equivalent axis vector k.

4- Consider the following sequence of transformations:

(a) Translation of $2cm$ along the world x-axis.

(b) Rotate by 60° about the current z-axis.

(c) Rotate by 90° about the world y-axis.

(d) Translation of $3cm$ along the world z-axis.

(e) Translation of $-5cm$ along the current x-axis.

(f) Rotate by 45° about the world x-axis.

Write the matrix product that will give the resulting Homogeneous Transformation matrix.

5- The frame 1 with respect to frame 0, is translated of 1m along x_0 and of 4m along y_0, moreover, it is rotated by 60° about z_0. If $P^1 = [5;\ -2;\ 0]^T$ find P^0.

6- For the figure shown below, find the Homogeneous Transformation matrices ${A_i}^{i-1}$ and ${A_i}^{0}$ for i=1, 2, 3, 4, 5.