

Homogeneous transforms solutions:

Task 2.10

$$R = R_{y,\psi} R_{x,\phi} R_{z,\theta}$$

Task 2.11

$$R = R_{z,\theta} R_{x,\phi} R_{x,\psi}$$

Task 2.12

$$R = R_{z,\alpha} R_{x,\phi} R_{z,\theta} R_{x,\psi}$$

Task 2.13

$$R = R_{z,\alpha} R_{z,\theta} R_{x,\phi} R_{x,\psi}$$

Task 2.37

2-39

$$H_1^0 = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix}; \quad H_2^0 = \begin{bmatrix} 1 & 0 & 0 & -0.5 \\ 0 & 1 & 0 & 1.5 \\ 0 & 0 & 1 & 1.1 \\ 0 & 0 & 0 & 1 \end{bmatrix}; \quad H_3^0 = \begin{bmatrix} 0 & 1 & 0 & -0.5 \\ 1 & 0 & 0 & 1.5 \\ 0 & 0 & -1 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$H_3^2 = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 1.9 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Task 2.38

$$H_2^1 = \begin{bmatrix} 1 & 0 & 0 & -.5 \\ 0 & 1 & 0 & .5 \\ 0 & 0 & 1 & .1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$H_2^0 = H_1^0 H_2^1 = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & -.5 \\ 0 & 1 & .5 & \\ 0 & 0 & 1 & .1 \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & -.5 \\ 0 & 1 & 0 & 1.5 \\ 0 & 0 & 1 & 1.1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$H_3^0 = H_2^0 H_3^2 = \begin{bmatrix} 1 & 0 & 0 & -.5 \\ 0 & 1 & 0 & 1.5 \\ 0 & 0 & 1 & 1.1 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 1.9 \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & -.5 \\ 0 & -1 & 0 & 1.5 \\ 0 & 0 & -1 & 3.0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Task 2.39

$$H_3^2 = \begin{bmatrix} 1 & 0 & 0 & -.3 \\ 0 & -1 & 0 & .4 \\ 0 & 0 & -1 & 1.9 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

The homogeneous transformation from the block frame to the base frame is

$$H_2^0 = \begin{bmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & .8 \\ 0 & 0 & 1 & .1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$