

(\*matrix transformations, rotation, tranlation, scaling\*)

In[35]:= **Clear["\*"];**

In[1]:= **I = IdentityMatrix[3] // MatrixForm(\*identity matrix\*)**

Out[1]//MatrixForm=

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

**x = IdentityMatrix[3][[All, 1]]**

**y = IdentityMatrix[3][[All, 2]]**

**z = IdentityMatrix[3][[All, 3]]**

Out[2]= {1, 0, 0}

Out[3]= {0, 1, 0}

Out[4]= {0, 0, 1}

In[20]:=  **$\alpha$ ;(\*rotation of x-axis\*)**

**RotationMatrix[ $\alpha$ , x] // MatrixForm**

Out[21]//MatrixForm=

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos[\alpha] & -\sin[\alpha] \\ 0 & \sin[\alpha] & \cos[\alpha] \end{pmatrix}$$

In[7]:=  **$\beta$ ;(\*rotation of y-axis\*)**

**RotationMatrix[ $\beta$ , y] // MatrixForm**

Out[8]//MatrixForm=

$$\begin{pmatrix} \cos[\beta] & 0 & \sin[\beta] \\ 0 & 1 & 0 \\ -\sin[\beta] & 0 & \cos[\beta] \end{pmatrix}$$

In[9]:=  **$\gamma$ ;(\*rotation of z-axis\*)**

**RotationMatrix[ $\gamma$ , z] // MatrixForm**

In[59]:= **t = {xo, yo, zo};(\*translation\*)**

**TranslationTransform[t]**

Out[60]= TransformationFunction $\left[\begin{pmatrix} 1 & 0 & 0 & | & x_0 \\ 0 & 1 & 0 & | & y_0 \\ 0 & 0 & 1 & | & z_0 \\ \hline 0 & 0 & 0 & | & 1 \end{pmatrix}\right]$

In[52]:= **s = {sx, sy, sz};(\*scale\*)**

**ScalingTransform[s]**

Out[52]= Null<sup>2</sup> TransformationFunction $\left[\begin{pmatrix} s_x & 0 & 0 & | & 0 \\ 0 & s_y & 0 & | & 0 \\ 0 & 0 & s_z & | & 0 \\ \hline 0 & 0 & 0 & | & 1 \end{pmatrix}\right]$

In[58]:= **m<sub>mw</sub> = TranslationTransform[t].ScalingTransform[s].RotationTransform[ $\alpha$ , x].**

**RotationTransform[ $\beta$ , y].RotationTransform[ $\gamma$ , z] // MatrixForm**

Out[58]//MatrixForm=

$$\text{TransformationFunction}\left[\begin{pmatrix} s_x \cos[\beta] \cos[\gamma] & -s_x \cos[\beta] \sin[\gamma] \\ s_y \cos[\gamma] \sin[\alpha] \sin[\beta] + s_y \cos[\alpha] \sin[\gamma] & s_y \cos[\alpha] \cos[\gamma] - s_y \sin[\alpha] \sin[\beta] \sin[\gamma] \\ -s_z \cos[\alpha] \cos[\gamma] \sin[\beta] + s_z \sin[\alpha] \sin[\gamma] & s_z \cos[\gamma] \sin[\alpha] + s_z \cos[\alpha] \sin[\beta] \sin[\gamma] \\ \hline 0 & 0 \end{pmatrix}\right]$$