1.11.1

EE24BTECH11020 - Ellanti Rohith

Question:Find a vector $\overrightarrow{r}$ equally inclined to the three axes and whose magnitude is $3\sqrt{3}$ units.

Solution: Let α be the angle made by the vector with the axes. The unit direction vector can be expressed as

$$\mathbf{x} = \begin{pmatrix} \cos\alpha \\ \cos\alpha \\ \cos\alpha \end{pmatrix} \tag{0.1}$$

$$\implies \|\mathbf{x}\| = 1 \tag{0.2}$$

$$\text{or, } \cos\alpha = \frac{1}{\sqrt{3}} \tag{0.3}$$

$$\mathbf{x} = \frac{1}{\sqrt{3}}(\hat{i} + \hat{j} + \hat{k}) \tag{0.4}$$

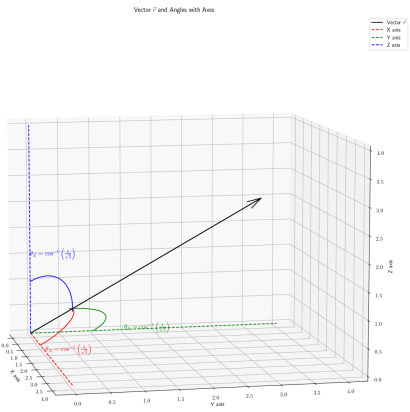
Given that $\|\mathbf{r}\| = 3\sqrt{3}$, we have:

$$\|\mathbf{r}\| = 3\sqrt{3} \tag{0.5}$$

$$\mathbf{x} = \frac{\mathbf{r}}{\|\mathbf{r}\|} \tag{0.6}$$

$$\implies \mathbf{r} = \mathbf{x}\|\mathbf{r}\| \tag{0.7}$$

$$\text{Thus, the vector } \mathbf{r} = (3\hat{i} + 3\hat{j} + 3\hat{k}) \tag{0.8}$$


Vector r
X axis
Y axis
Z axis
$\theta_Z = \cos^{-1}\left(\frac{z}{|\vec{r}|}\right)$
$\theta_X = \cos^{-1}\left(\frac{x}{|\vec{r}|}\right)$
$\theta_Y = \cos^{-1}\left(\frac{y}{|\vec{r}|}\right)$
X axis
Y axis
Z axis