MatGeo Assignment 4.4.3

AI25BTECH11007

Question:
Equation of the line passing through the origin and making 30° , 60°, and 90° with the X, Y, Z axes respectively is.

Solution:
The line makes angles of $30°, 60°, 90°$ with the X, Y, Z axes respectively.

Hence the direction cosines are:

$$\begin{pmatrix} \cos 30° \\ \cos 60° \\ \cos 90° \end{pmatrix} = \begin{pmatrix} \frac{\sqrt{3}}{2} \\ \frac{1}{2} \\ 0 \end{pmatrix}$$

let the direction vector be:

$$\mathbf{d} = \begin{pmatrix} \sqrt{3} \\ 1 \\ 0 \end{pmatrix}.$$

Since the line passes through the origin $\begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$, any point $\mathbf{r}$ on the line is given in parametric form as:

$$\mathbf{r}(t) = \mathbf{r}_0 + t\mathbf{d} = t \begin{pmatrix} \sqrt{3} \\ 1 \\ 0 \end{pmatrix}, \quad t \in \mathbb{R}.$$

Thus, the parametric equations of the line are:

$$x = \sqrt{3}t, \quad y = t, \quad z = 0.$$

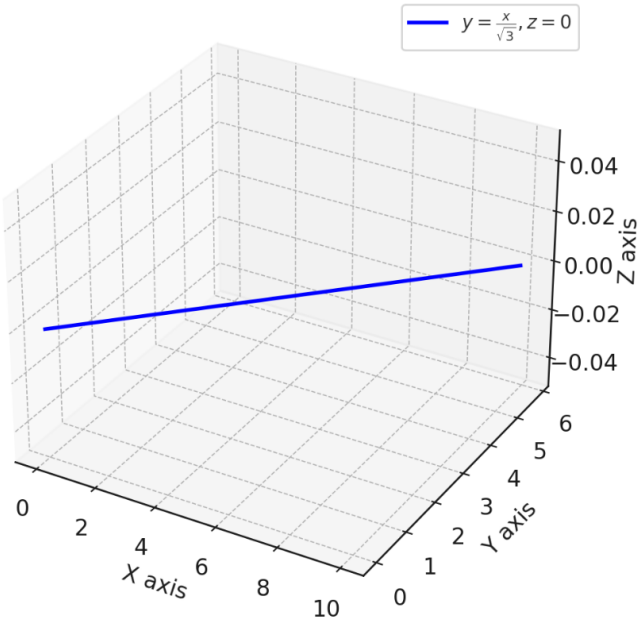
$y = \frac{x}{\sqrt{3}}, z = 0$
0.04
0.02
0.00
−0.02
−0.04
Z axis
0
2
4
6
8
10
X axis
0
1
2
3
4
5
6
Y axis

Fig. 0.1: Plot