1.1.11.6

EE24BTECH11024 - G. Abhimanyu Koushik

Question:
Find the direction cosines of a line which makes equal angles with the coordinate axes
Solution:

Symbol	Description
A	direction vector of line
B	unit vector in direction of line

TABLE 0: Variables Used

A vector which subtends equal angles to all axes will have equal components. Let

$$\mathbf{A} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \tag{1}$$

$$\|\mathbf{A}\| = \sqrt{\mathbf{A}^\top \mathbf{A}} \tag{2}$$

$$= \sqrt{\begin{pmatrix} 1 & 1 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}} \tag{3}$$

$$\implies \|\mathbf{A}\| = \sqrt{3} \tag{4}$$

The unit direction vector of the line is

$$\frac{\mathbf{A}}{\|\mathbf{A}\|} = \frac{1}{\sqrt{3}} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} = \begin{pmatrix} \frac{1}{\sqrt{3}} \\ \frac{1}{\sqrt{3}} \\ \frac{1}{\sqrt{3}} \end{pmatrix} \tag{5}$$

$$\mathbf{B} = \begin{pmatrix} \frac{1}{\sqrt{3}} \\ \frac{1}{\sqrt{3}} \\ \frac{1}{\sqrt{3}} \end{pmatrix} \tag{6}$$

Hence, the direction cosines of the line are $\frac{1}{\sqrt{3}}$, $\frac{1}{\sqrt{3}}$ and $\frac{1}{\sqrt{3}}$.

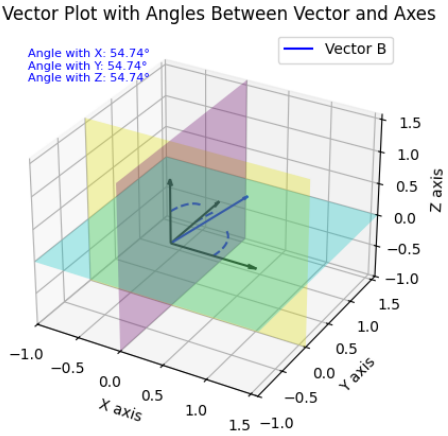

Fig. 0: Line with equal direction ratios, where **B** is unit direction vector