1.10.2

EE25BTECH11047 - RAVULA SHASHANK REDDY

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Question:

Find the unit vector in the direction of the sum of the vectors $\mathbf{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\mathbf{b} = 2\hat{j} + \hat{k}$.

Solution:

Given

$$\mathbf{a} = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix} \tag{1}$$

$$\mathbf{b} = \begin{pmatrix} 0 \\ 2 \\ 1 \end{pmatrix}. \tag{2}$$

Sum of the vectors:

$$\mathbf{a} + \mathbf{b} = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix} + \begin{pmatrix} 0 \\ 2 \\ 1 \end{pmatrix} = \begin{pmatrix} 2 \\ 1 \\ 2 \end{pmatrix}. \tag{3}$$

Norm of $\mathbf{a} + \mathbf{b}$:

$$\|\mathbf{a} + \mathbf{b}\| = \sqrt{\begin{pmatrix} 2 & 1 & 2 \end{pmatrix} \begin{pmatrix} 2 \\ 1 \\ 2 \end{pmatrix}} = \sqrt{2 \cdot 2 + 1 \cdot 1 + 2 \cdot 2} = \sqrt{9} = 3. \tag{4}$$

Using the unit vector formula :

$$\mathbf{u} = \frac{\mathbf{a} + \mathbf{b}}{\|\mathbf{a} + \mathbf{b}\|} \tag{5}$$

$$\mathbf{u} = \frac{1}{3} \begin{pmatrix} 2 \\ 1 \\ 2 \end{pmatrix}. \tag{6}$$

$$\therefore \mathbf{u} = \begin{pmatrix} \frac{2}{3} \\ \frac{1}{3} \\ \frac{2}{3} \end{pmatrix} \tag{7}$$

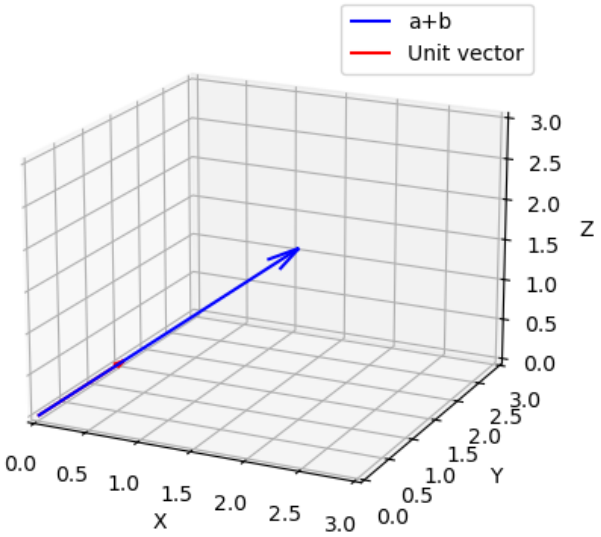
a+b
Unit vector
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Z
0.0
0.5
1.0
1.5
2.0
2.5
3.0
X
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Y

Figure 1