1.11.14

AI25BTECH11012 - GARIGE UNNATHI

Question:
If $\mathbf{a} = 4\hat{i} - \hat{j} + \hat{k}$ and $\mathbf{b} = 2\hat{i} - 2\hat{j} + \hat{k}$, then find a unit vector parallel to the vector $\mathbf{a} + \mathbf{b}$.

Solution:

Variable	Formula
a	$a = \begin{pmatrix} 4 \\ -1 \\ 1 \end{pmatrix}$
b	$b = \begin{pmatrix} 2 \\ -2 \\ 1 \end{pmatrix}$

TABLE 0: Variables Used

The unit vector in the direction of the vector $\mathbf{a} + \mathbf{b}$ is given by the equation :

$$\frac{\mathbf{a} + \mathbf{b}}{\|\mathbf{a} + \mathbf{b}\|}$$

$$\mathbf{a} + \mathbf{b} = \begin{pmatrix} 4 \\ -1 \\ 1 \end{pmatrix} + \begin{pmatrix} 2 \\ -2 \\ 1 \end{pmatrix} = \begin{pmatrix} 6 \\ -3 \\ 2 \end{pmatrix} \tag{0.1}$$

$$\frac{\mathbf{a} + \mathbf{b}}{\|\mathbf{a} + \mathbf{b}\|} = \frac{1}{7}\begin{pmatrix} 6 \\ -3 \\ 2 \end{pmatrix} \tag{0.2}$$

$$= \begin{pmatrix} \frac{6}{7} \\ -\frac{3}{7} \\ \frac{2}{7} \end{pmatrix} \tag{0.3}$$

Hence the unit vector in the direction of the vector $\mathbf{a} + \mathbf{b}$ is $\begin{pmatrix} \frac{6}{7} \\ -\frac{3}{7} \\ \frac{2}{7} \end{pmatrix} = \frac{6}{7}\hat{i} - \frac{3}{7}\hat{j} + \frac{2}{7}\hat{k}$

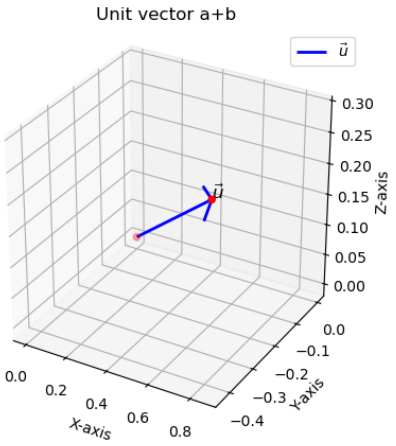
Unit vector a+b
$\vec{u}$
$\vec{u}$
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Z-axis
0.0
−0.1
−0.2
−0.3
−0.4
Y-axis
0.0
0.2
0.4
0.6
0.8
X-axis

Fig. 0.1