2.10.49

EE25BTECH11020 - Darsh Pankaj Gajare

Question:
The unit vector which is orthogonal to the vector $3\hat{i}+2\hat{j}+6\hat{k}$ and is coplanar with vectors $2\hat{i}+\hat{j}+\hat{k}$ and $\hat{i}-\hat{j}+\hat{k}$ is

1) $\frac{2\hat{i}-6\hat{j}+\hat{k}}{\sqrt{41}}$
2) $\frac{2\hat{i}-3\hat{j}}{\sqrt{13}}$
3) $\frac{3\hat{i}-\hat{k}}{\sqrt{10}}$
4) $\frac{4\hat{i}+3\hat{j}-3\hat{k}}{\sqrt{34}}$

Solution: Given:

TABLE I: Given data

Vector	matrix
A	$\begin{pmatrix}2\\1\\1\end{pmatrix}$
B	$\begin{pmatrix}1\\-1\\1\end{pmatrix}$
C	$\begin{pmatrix}3\\2\\6\end{pmatrix}$

To find: **P** **Solution:**

$$\mathbf{P} = \alpha\mathbf{A} + \beta\mathbf{B} \tag{1}$$

$$\mathbf{P}^T\mathbf{C} = 0 \tag{2}$$

$$\begin{pmatrix}\mathbf{A} & \mathbf{B}\end{pmatrix}^T \mathbf{C}\begin{pmatrix}\alpha\\ \beta\end{pmatrix} = 0 \tag{3}$$

$$\begin{pmatrix}\mathbf{A}^T\mathbf{C} & \mathbf{B}^T\mathbf{C}\end{pmatrix}\begin{pmatrix}\alpha\\ \beta\end{pmatrix} = 0 \tag{4}$$

$$\begin{pmatrix}\mathbf{A}^T\mathbf{C} & \mathbf{B}^T\mathbf{C}\end{pmatrix} = \begin{pmatrix}14 & 7\end{pmatrix} \tag{5}$$

$$2\alpha+\beta = 0 \implies \beta = -2\alpha \tag{6}$$

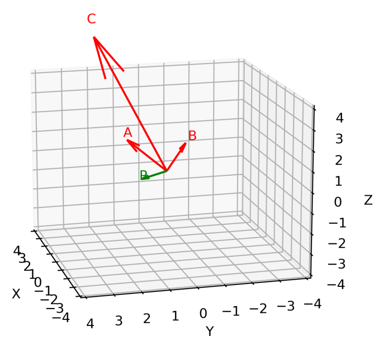
$$\mathbf{P} = \begin{pmatrix}2\alpha+\beta\\ \alpha-\beta\\ \alpha+\beta\end{pmatrix} \tag{7}$$

Therefore,

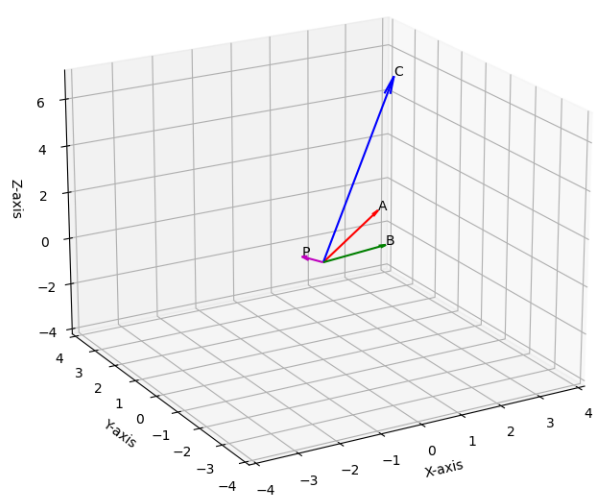
$$\mathbf{P} = \alpha\begin{pmatrix}0\\3\\-1\end{pmatrix} \tag{8}$$

Normalizing,

$$\mathbf{P} = \pm\frac{1}{\sqrt{10}}\begin{pmatrix} 0 \\ 3 \\ -1 \end{pmatrix} \tag{9}$$



Plot using C function



Plot using Python