4.4.13

AI25BTECH11036-SNEHAMRUDULA

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Find the projection of vector $(\mathbf{b} + \mathbf{c})$ on vector $\mathbf{a}$, where

$$\mathbf{a} = 2\hat{i} + 2\hat{j} + \hat{k}, \quad \mathbf{b} = \hat{i} + 3\hat{j} + \hat{k}, \quad \mathbf{c} = \hat{i} + \hat{k}. \tag{1}$$

Theoretical Solution

Let us solve the given equation theoretically and then verify the solution computationally
According to the question,
Given three vectors

$$\mathbf{a} = \begin{pmatrix} 2 \\ 2 \\ 1 \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} 1 \\ 3 \\ 1 \end{pmatrix} \quad \mathbf{c} = \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} \tag{2}$$

$$\mathbf{b} + \mathbf{c} = \begin{pmatrix} 2 \\ 3 \\ 2 \end{pmatrix} \tag{3}$$

Projection of vector $(\mathbf{b} + \mathbf{c})$ is $k\frac{\mathbf{a}}{\|\mathbf{a}\|}$

$$K = \frac{(\mathbf{b} + \mathbf{c})^T \mathbf{a}}{\|\mathbf{a}\|} = 4 \tag{4}$$

$$\text{Projection of vector } (\mathbf{b} + \mathbf{c}) = \begin{pmatrix} 2.67 \\ 2.67 \\ 1.33 \end{pmatrix} \tag{5}$$