

2.5.28

EE25BTECH11060 - V.Namaswi

Question

Find the projection of the vector

$$\mathbf{a} = 2\mathbf{i} + 3\mathbf{j} + 2\mathbf{k}$$

on the vector

$$\mathbf{b} = 2\mathbf{i} + 2\mathbf{j} + \mathbf{k}.$$

solution

given,

Vector	i-component	j-component	k-component
a	2	3	2
b	2	2	1

TABLE 0: Components of vectors **a** and **b**

Projection of vector **A** on **B** is given by

$$\frac{\mathbf{A}^\top \mathbf{B}}{\|\mathbf{B}\|^2} \mathbf{B} \quad (1)$$

$$\Rightarrow \frac{\begin{pmatrix} 2 & 3 & 2 \end{pmatrix} \begin{pmatrix} 2 \\ 2 \\ 1 \end{pmatrix}}{2^2 + 2^2 + 1^2} \mathbf{B} \quad (2)$$

$$= \frac{2^2 + (3)(2) + (2)(1)}{2^2 + 2^2 + 1^2} \begin{pmatrix} 2 \\ 2 \\ 1 \end{pmatrix} \quad (3)$$

$$= \frac{12}{9} \begin{pmatrix} 2 \\ 2 \\ 1 \end{pmatrix} \quad (4)$$

$$= \frac{4}{3} \begin{pmatrix} 2 \\ 2 \\ 1 \end{pmatrix} \quad (5)$$

$$= \begin{pmatrix} \frac{8}{3} \\ \frac{8}{3} \\ \frac{4}{3} \end{pmatrix} \quad (6)$$

The projection vector is given by $\frac{8}{3}\mathbf{i} + \frac{8}{3}\mathbf{j} + \frac{4}{3}\mathbf{k}$

Refer fig

Projection of Vector a onto Vector b

