ASSIGNMENT 4

Amulya Tallamraju
AI20BTECH11003

Download all python codes from

https://github.com/AmulyaTallamraju/EE3900/blob/main/Assignment−4/codes/Assignment−4.py

and latex-tikz codes from

https://github.com/AmulyaTallamraju/EE3900/blob/main/Assignment−4/Assignment−4.tex

1 Linear forms 2.36

Find the coordinates of the point where the line through $\begin{pmatrix}5\\1\\6\end{pmatrix}$ and $\begin{pmatrix}3\\4\\1\end{pmatrix}$ crosses the YZ-plane.

2 SOLUTION

The equation of the line is

$$\mathbf{x} = \mathbf{A} + \lambda\,(\mathbf{B} - \mathbf{A}) \tag{2.0.1}$$

The equation of the plane can be represented as

$$\mathbf{n}^T\mathbf{x} = c \tag{2.0.2}$$

The point of intersection of the line and the plane satisfies the plane equation and is given by

$$c = \mathbf{n}^T(\mathbf{x}) \tag{2.0.3}$$
$$= \mathbf{n}^T(\mathbf{A} + \lambda\,(\mathbf{B} - \mathbf{A})) \tag{2.0.4}$$

Thus,

$$\lambda = \frac{c - \mathbf{n}^T\mathbf{A}}{\mathbf{n}^T(\mathbf{B} - \mathbf{A})} \tag{2.0.5}$$

The point of intersection is then given by

$$\mathbf{x} = \mathbf{A} + \left(\frac{c - \mathbf{n}^T\mathbf{A}}{\mathbf{n}^T(\mathbf{B} - \mathbf{A})}\right)(\mathbf{B} - \mathbf{A}) \tag{2.0.6}$$

For the given problem,

$$\mathbf{A} = \begin{pmatrix}5\\1\\6\end{pmatrix} \tag{2.0.7}$$

$$\mathbf{B} = \begin{pmatrix}2\\-3\\5\end{pmatrix} \tag{2.0.8}$$

$$\mathbf{n} = \begin{pmatrix}1\\0\\0\end{pmatrix} \tag{2.0.9}$$

$$c = 0 \tag{2.0.10}$$

Solving the above we get

$$\lambda = \frac{-5}{2} \tag{2.0.11}$$

Substituting the value of λ we have the point of contact as

$$\mathbf{x} = \begin{pmatrix}5\\1\\6\end{pmatrix} - \frac{5}{2}\begin{pmatrix}2\\-3\\5\end{pmatrix} = \frac{1}{2}\begin{pmatrix}0\\17\\-13\end{pmatrix} \tag{2.0.12}$$

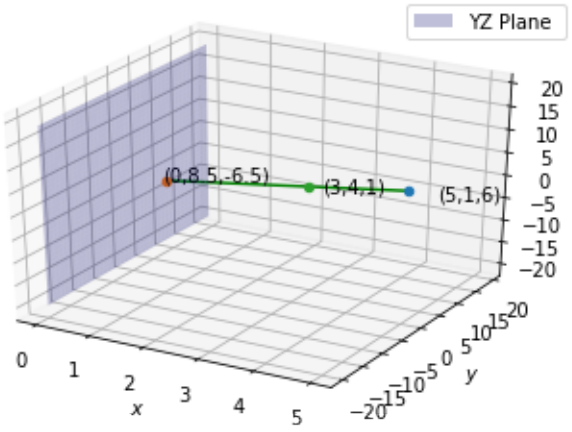

Fig. 0: Line and point of intersection