

4.2.16

EE25BTECH11013 - Bhargav

Question:

Find the direction and normal vector for the line

$$2 + 3y = 7x \quad (0.1)$$

Solution:

The line can be written as:

$$7x - 3y = 2 \quad (0.2)$$

This equation can be expressed in terms of matrices
Let

$$\mathbf{x} = \begin{pmatrix} x \\ y \end{pmatrix} \quad (0.3)$$

$$\mathbf{n}^T = \begin{pmatrix} 7 & -3 \end{pmatrix} \quad (0.4)$$

$$c = 2 \quad (0.5)$$

The line equation can be written as:

$$\mathbf{n}^T \mathbf{x} = c \quad (0.6)$$

Where \mathbf{n} is the normal vector of the given line

The direction vector of the line can be found by observing the normal vector.

$$\mathbf{m} = \begin{pmatrix} 3 \\ 7 \end{pmatrix} \quad (0.7)$$

This is true because if the director vector is represented as

$$\mathbf{m} = \begin{pmatrix} 1 \\ m \end{pmatrix} \quad (0.8)$$

then the normal vector can be represented as

$$\mathbf{n} = \begin{pmatrix} -m \\ 1 \end{pmatrix} \quad (0.9)$$

This can be verified by the following equation:

$$\mathbf{n}^T \mathbf{m} = 0 \quad (0.10)$$

$$\begin{pmatrix} 7 & -3 \end{pmatrix} \begin{pmatrix} 3 \\ 7 \end{pmatrix} = 0 \quad (0.11)$$

The normal vector of the line is $\mathbf{n} = \begin{pmatrix} 7 \\ -3 \end{pmatrix}$ The director vector of the line is $\mathbf{m} = \begin{pmatrix} 3 \\ 7 \end{pmatrix}$

From the figure, it is clearly verified that the theoretical solution matches with the computational solution.

