Assignment 4

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Download all the python codes from

https://github.com/cmaspi/EE3900/tree/main/Assignment−4/code

latex-tikz codes from

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

1 Problem

(Linear forms Q 2.40) Find the equation of the plane passing through the line of intersection of the planes

$$\begin{pmatrix}1 & 1 & 1\end{pmatrix}\mathbf{x} = 1 \text{ and} \tag{1.0.1}$$

$$\begin{pmatrix}2 & 3 & -1\end{pmatrix}\mathbf{x} = -4 \tag{1.0.2}$$

and parallel to x-axis

2 Solution

The equations of planes are

$$p_1 : \mathbf{n_1}^T x = 1 \tag{2.0.1}$$

$$p_2 : \mathbf{n_2}^T x = -4 \tag{2.0.2}$$

where

$$\mathbf{n_1} = \begin{pmatrix}1 & 1 & 1\end{pmatrix}^T \tag{2.0.3}$$

$$\mathbf{n_2} = \begin{pmatrix}2 & 3 & -1\end{pmatrix}^T \tag{2.0.4}$$

A family of planes is defined by the set of planes which have a common line of intersection. Any arbitrary plane in this family can be written as

$$p = p_2 + \lambda p_1 \tag{2.0.5}$$

$$(\mathbf{n_2} + \lambda \mathbf{n_1})^T \mathbf{x} = d_2 + \lambda d_1 \tag{2.0.6}$$

The plane is parallel to x-axis

$$\therefore \mathbf{e_1}^T(\mathbf{n_2} + \lambda \mathbf{n_1}) = 0 \tag{2.0.7}$$

$$\implies \lambda = -2 \tag{2.0.8}$$

The required plane is given by

$$(\mathbf{n_2} - 2\mathbf{n_1})^T \mathbf{x} = d_2 - 2d_1 \tag{2.0.9}$$

$$\begin{pmatrix}0 & 1 & -3\end{pmatrix}\mathbf{x} = -6 \tag{2.0.10}$$

A plot for the planes is given below

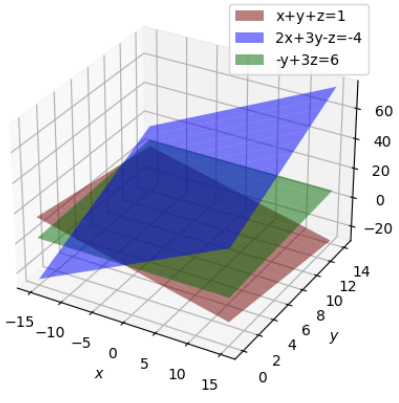

Fig. 0: Plot of the planes