Assignment 2 EE5609

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***Abstract*—This assignment finds the values of vectors by Gaussian Row Elimination.**

Download python code from

https://github.com/Atul191/EE−5609−Assignment/blob/master/Gaussian Elimination.py

1 Problem Statement

1.1 Find the value of a,b,c and d:

$$\begin{pmatrix} a-b & 2a+c \\ 2a-b & 3c+d \end{pmatrix} = \begin{pmatrix} -1 & 5 \\ 0 & 13 \end{pmatrix} \tag{1}$$

1.2 Solution

Equate (1) in the form:

$$\begin{pmatrix} 1 & -1 & 0 & 0 \\ 2 & 0 & 1 & 0 \\ 2 & -1 & 0 & 0 \\ 0 & 0 & 3 & 1 \end{pmatrix} \begin{pmatrix} a \\ b \\ c \\ d \end{pmatrix} = \begin{pmatrix} -1 \\ 5 \\ 0 \\ 13 \end{pmatrix} \tag{2}$$

Using augmented matrix and row reduction on (2) we deduce in following steps

$$\begin{pmatrix} 1 & -1 & 0 & 0 & -1 \\ 2 & 0 & 1 & 0 & 5 \\ 2 & -1 & 0 & 0 & 0 \\ 0 & 0 & 3 & 1 & 13 \end{pmatrix} \tag{3}$$

Row elimination:

$$\begin{pmatrix} 1 & -1 & 0 & 0 & -1 \\ 2 & 0 & 1 & 0 & 5 \\ 2 & -1 & 0 & 0 & 0 \\ 0 & 0 & 3 & 1 & 13 \end{pmatrix} \tag{4}$$

$$\xleftrightarrow[R_3 \leftarrow R_3 - 2R1]{R_2 \leftarrow R_2 - 2R_1} \begin{pmatrix} 1 & -1 & 0 & 0 & -1 \\ 0 & 2 & 1 & 0 & 7 \\ 0 & 1 & 0 & 0 & 2 \\ 0 & 0 & 3 & 1 & 13 \end{pmatrix} \tag{5}$$

$$\xleftrightarrow[R_4 \leftarrow R_4 - (-6)R_3]{R_3 \leftarrow R_3 - \frac{-1}{2} R_2} \begin{pmatrix} 1 & -1 & 0 & 0 & -1 \\ 0 & 2 & 1 & 0 & 7 \\ 0 & 0 & \frac{-1}{2} & 0 & \frac{-3}{2} \\ 0 & 0 & 0 & 1 & 4 \end{pmatrix} \tag{6}$$

Now performing back substitution on (6) we deduce the following:

$$\mathbf{d} = 4 \tag{7}$$

$$\frac{-1}{2}\mathbf{c} = \frac{-3}{2} \tag{8}$$

$$\implies \mathbf{c} = 3 \tag{9}$$

$$2\mathbf{b} + \mathbf{c} = 7 \tag{10}$$

$$\implies \mathbf{b} = 2 \tag{11}$$

$$\mathbf{a} + \mathbf{b} = -1 \tag{12}$$

$$\implies \mathbf{a} = 1 \tag{13}$$

Solution:

$$\mathbf{a} = 1, \mathbf{b} = 2, \mathbf{c} = 3, \mathbf{d} = 4$$