Application Of Matrices In Engineering

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Abstract:

Engineering mathematics is applicable in our daily life. Applied mathematics is the future classified as vector algebra, differential calculus, integration, discrete mathematics, Matricesand determinant etc. Matrices have a long history of application in solving linear equations. Matrix mathematics applies to several branches of science, as well as different mathematical disciplines. We can see the results of matrix in every computer-generated image that has a reflection or distortion effects such as light passing through rippling water. Before computer graphics, the science of optics used matrix to account for reflection and for refraction. In mathematics, one application of matrix notation supports graph theory. In an adjacency matrix, the integer value of each element indicates how many connections a particular node has.

Keywords: Matrices, determinant, differential, calculus, integration, discrete mathematics.

I.INTRODUCTION

Matricesare a two dimensional arrangement of numbers in row(s) and column(s) enclosed by a pair of square brackets or can say matrices are nothing but the rectangular arrangement of numbers,expressions, symbols which are arranged in row(s) and column(s). Matrices find many applications in scientific field and apply to practical real life problems as well, making an indispensable concept for solving many practical problems. Matrices are used in representing the real World data like the traits of people's population, habits, etc. Matrices can be solved physical related application and one applied in the study of electrical circuits, quantum mechanics and optics, with the help of matrices, calculation of battery power outputs, resistor conversion of electrical energy into another useful energy. These matrices play a role in calculations. Matrix mathematics simplifies linear algebra, at least in providing a more compact way to deal with groups of equations in linear algebra. Some properties of matrix mathematics are important in mathematics theory. Matrices are also used in robotics and automation in terms of base elements for the robot movements. The movements of the robots are programmed with the calculation of matrices row and column "controlling of matrices are done by calculation of matrices".

II. HISTORY

First concept of Mathematics was applied on around 1850 A.D but it is used were applicable in ancient era. The Latin word of matrix is worm. It can also mean more generally any place which something formed or produced. Matrices have a long history of applications in solving linear equations, between 300BC and AD200. The first example of the use of matrix methods to solve simultaneous equations including the concept of determinants, easily matrix theory emphasizes determinants more strongly than matrices and an independent matrix concept akin to the modern notion emerged only in 1858.

III. APPLICATION

Application of Matrices in write, encodes, decode and send secret message.Mathematics puzzles, games, government and military organization websites financial information like credit card number and bank account, information security, all related encode, decode, theory a secret message in which matrices play a very important role.

The coding and decoding is also utilizing in

1. Steganography
2. Cryptography

1. Steganography: Matrices are used to cover channels, hidden tent within web pages, hidden files in plain sight, null ciphers and steganography. In recent wireless internet connection through mobile phone, known as wireless application protocol (wap) also utilize matrices in the form of stenography.

2. Cryptography: Cryptography also utilize matrices, cryptography is science of information security, the word cryptography derives from word Krypto's which means hidden. These technologies hide information in storage or transits.

In the Encryption process:

First text of the message into a steam of numerical rules and the place the data into a matrices and multiply the data by the encoding matrices at last convert the matrices into a steam of numerical values that contains the encrypted message.

The basic idea of cryptography is that information can be encoded using an encryption scheme and decoded by anyone who knows the scheme. There are lots of encryption schemes ranging from very simple to very complex. Most of them are mathematical in nature. Today, sensitive information is sent over the Internet every second, credit card numbers, personal information, bank account numbers, letters of credit, passwords for important databases, etc. Often, that information is encoded or encrypted. The encoder is a matrix and the decoder is its inverse. Let A be the encoding matrix, M the message matrix, and X will be the encrypted matrix (the sizes of A and M will have to be consistent and will determine the size of X). Then, mathematically, the operation is ***AM = X.***

Someone has X and knows A, and wants to recover M, the original message. That would be the same as solving the matrix equation for M. Multiplying both sides of the equation on the left by A-1 we have ***M = A-1X.*** (**Note:** A must have an inverse).

Example:

Let,A=1, B=2, C=3, and so on, let a blank be represented by 0. Let us encode the message "I LOVE MY INDIA". We need to translate letters into numbers.

Using the above list, the message becomes:

9,0,12,15,22,5,0,13,25,0,9,14,4,9,1.

Now we need to decide on a coding matrix.

$$A=\begin{bmatrix} 3 & 1 & 2 \\ 2 & 0 & 1 \\ 3 & 4 & 5 \end{bmatrix}$$

Since, this is a 3 x 3 matrix, we can encode only 3 numbers at a time. We break the message into packets of 3 numbers each, adding blanks to the end if necessary. The first group is 9, 0, 12. The message matrix will be 3 x1.

$$\begin{bmatrix} 3 & 1 & 2 \\ 2 & 0 & 1 \\ 3 & 4 & 5 \end{bmatrix}\begin{bmatrix} 9 \\ 0 \\ 12 \end{bmatrix} = \begin{bmatrix} 51 \\ 30 \\ 87 \end{bmatrix}$$

So, the first 3 encrypted numbers are 51, 30, 87.
Next 3 encrypted numbers are 15, 22, 5.

$$\begin{bmatrix} 3 & 1 & 2 \\ 2 & 0 & 1 \\ 3 & 4 & 5 \end{bmatrix}\begin{bmatrix} 15 \\ 22 \\ 5 \end{bmatrix} = \begin{bmatrix} 77 \\ 35 \\ 158 \end{bmatrix}$$

The second group is 77, 35, 158.

Encoding the entire sequence gives us the encrypted message:
51,30,87,77,35,158,63,25,177,37,14,106,23,9,53.

$$A^{-1} = \begin{bmatrix} 4/3 & 1 & -1/3 \\ 7/3 & 0 & -1/3 \\ -8/3 & 4 & 2/3 \end{bmatrix}$$

Let's decode it using the inverse matrix.
Decoding the first 3 numbers, we have,

$$\begin{bmatrix} 4/3 & 1 & -1/3 \\ 7/3 & 0 & -1/3 \\ -8/3 & 4 & 2/3 \end{bmatrix} \begin{bmatrix} 50 \\ 30 \\ 87 \end{bmatrix} = \begin{bmatrix} 9 \\ 0 \\ 12 \end{bmatrix}$$

The first 3 numbers decode as the first 3 numbers in the original message.Matrix encryption is just one of many schemes. Every year, the National SecurityAgency, the military and private corporations hire hundreds of people to devisenew schemes and decode existing ones.

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