Gauss Jordan Method to Obtain Solution of Simultaneous Equation

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Abstract- **The review paper consists of GAUSS JORDAN METHOD using MATLAB to solve simultaneous algebraic equations by row and column elimination. In MATLAB there is a proper set of codes that is given as input, and the desired output result is obtained. The GAUSS JORDAN METHOD is also used for solving of simultaneous algebraic equations. The augmented matrix is reduced to echelon form and then the desired result is obtained**

1. INTRODUCTION

The GAUSS ELIMINATION Method is named after Mathematician Carl Friedrich Gauss and Wilhelm Jordan, after their Name
It Is Called So. It is a Technique in Which A System of Linear Equations Is Resolved By Means Of Matrices.[6]

2.GAUSS JORDAN METHOD

Gauss Jordan method is a method to solve linear simultaneous algebraic equations. This method involves transformation of rows and columns to reduce the matrix into echelon form. Gauss Jordan method is also useful in finding inverse of a matrix. Solve the following system of equations using GAUSS JORDAN METHOD.[2] { x+2yz+3v+w=2, 2x+4y-2z+6v+3w=6, -x2y+zv+3w=4}?
It is a system of 3 equations in 5 variables. So, there are not any unique solutions. The most we can do is get 3 linear independent equations.in this case the equations are actually very similar , if we multiply the first equations by 2 and subtract it from the second equation , we get w=2 .if we add the first and third equations , we get 2v+4w=6.
Substituting w=2 gives us v= -1. This just leaves us with x+2y-z=3. That's all we can find out from the given in this method: Information.

3. GAUSS JORDAN METHOD IN MATLAB. CODE

Gauss Jordan Method
MATLAB
Function[X,err]=gauss_jordan_elim(a,b) [2]
D = [0 2 1; 1 1 2; 2 1 1] [3]
E= [4; 6; 7] 4 [1] [a,b]=size(D); 5 err =0; 6 X=zeros(a,1);.
7 if ~= a b 8 disp('error: a~=b'); 9 err = 1; 10 end 11 if length(E) ~= a 12 disp('error: wrong size of E'); 13 err = 2; 14 else 15 if size(E,2) ~= 1 16 E=E'; 17 end 18 if size(E,2) ~= 1 19 disp('error: E is a matrix'); 20 err = 3; 21 end 22 end 23 if err == 0 24 A=[D,E]; 25 for i=1:a 26
[A (i:a,i:a+1),err]=gauss_pivot(A(i:a,i:a+1)); 27 if err == 0 28
A(1:a,i:a+1)=gauss_jordan_step(A(1:a,i:a+ 1),i); 29 end 30 end 31 x=A(:,a+1); 32 end
33 D=0; 34 function
A1=gauss_jordan_step(D,i) 35 36 [a,b]=size(D); 37 D1=D; 38 S=D1(i,1); 39
D1(i,:) = D(i,:)/S; 40 k=[[1:i-1],[i+1:a]]; 41 for j=k 42 S=D1(j,1); 43 D1(j,:)=D1(j,:)D1(i,:)*S;
44 end 45 function
[D1, err]=gauss_pivot(D) 46 [a,b]=size(D);. 47 D1=D; 48 err = 0; % error flag 49 if
D1 (1,1) == 0 50 check= logical(1);. 51 i = 1; 52 while check 53 i = i + 1; 54 if i > a 55 disp('error: matrix is singular'); 56 err = 1; 57 check = logical(0); 58 else 59 if D(i,1) ~= 0 & check 60 check = logical(0);
61 E=E1(i,:); 62 D1(i,:)=D1(1,:); 63 D1(1,:)=E; 764 end 65 end 66 end 67 end The given program code is for solving the following equations using Gauss Jordan method in MATLAB: 0x + 2y + 1z = 4 1x + 1y + 2z = 6 2x + 1y+ 1z = 7 Therefore in the program, the value of A = [0 2 1;1 1 2; 2 1 1] and that of B = [4;6;7]. In order to run the program, use the

code source with new inputs as mentioned in the questions[3]. A result of the program is given below: 021|4 112|6 211|7 X=11/5 Y=7/5 Z=6/5 Gauss Elimination Method Named after Carl Friedrich Gauss, Gauss Elimination Method is a method of linear algebra used for solving linear algebraic equations using Matrix method. The equations are converted into Matrix form and then row operations are performed on it. The row operations are used to reduce the matrix in Echleon form. Gauss Elimination Method (DERIVATION): The following equations are being taken into account: D1X+ E1Y+ F1Z= G1 D2X+ E2Y+ F2Z= G2 D3X+ E3Y+ F3Z= G3 We need to convert the above equations in matrix format to apply Gauss Elimination Method, Hence the matrix form is as follows:- A 6=D1 E1 F1 D2 E2 F2 D3 E3 F3 B = G1 G2 G3 The matrices are A and B are converted into Augmented form: 5D1 E1 F1 | G1 D2 E2 F2 | G2 D3 E3 F3 | G3 Now, we perform row and column operations to find the echelon form of the matrix by using following techniques:- Exchanging two rows Adding certain multiple to one or two row Multiplying the entire row by a non zero number 1This procedure is repeated until the augmented matrix is re1x=a , y= a and z=c . The Gaussian elimination method of MATLAB is based on this derivation.

Gauss Elimination Method in MATLAB:
Gauss Elimination Method MATLAB
Program 1 function C =
[6]gauss_elimination(A,B) 2 A=[2 1 -1; -3
-1 2; -2 1 2] 3 B = [8;-11;-3] 4 i = 1; 5 x = [A B]; 6 [nx mx] = size(x); 7 while i <= nx 8 if x(i,i) == 0 9 disp('Diagonal element zero') 10 return 11 end 12 x = elimination(X,i,i); 13
1i = i +1; 14 end 15 C
= x(:,mx); 16 function
x = elimination(x,i,j); 17 [2nx mx] = size(x); 18 a = x(i,j); 19 x(i,:) = x(i,:)/a; 20 for k = 1:nx 21 if k == i 22 continue 23 end 24 x(k,:) = x(k,:) – x(i,:)*x(k,j); 25 end 26 27 28 29 30 1[4]The above code for Gauss Elimination method can be used for solving every type of Linear Algebraic Simultaneous Equations in MATLAB. 1The order of the matrix depends upon the number of equations are available and hence the number of variables also increase or decrease depending upon the number of equations[1]. The above MATLAB 1code is used to solve the following system of equations: 2X + Y – Z= 8 -3X – Y + 2Z = -11 -X + Y +2Z = -3 The value of matrix A and B are respectively [2 1 -1; -3 -1 2; -2 1 2] and [8 ; -11 ; -3] The output of the MATLAB source is given below: Concept Of Pivoting Pivot are the diagonal elements that divide the matrix into two parts. These elements must be non zero in case of Gauss Elimination Method to provide high level of accuracy and stability to the numerical. In case of a zero element the concept of Partial or Complete Pivoting is applied based on the type of numerical and requirement. Pivoting is followed by interchanging of rows and columns to bring out the pivot value and perform the remaining functions to reduce the round off and approximation error in the output. Partial Pivoting In partial pivoting, the method selects the largest absolute value in the column of the pivot and is known as pivoting element. The partial pivoting is used to avoid round off error by selecting the largest absolute element as pivoting element. Complete Pivoting In complete pivoting the maximal element is used as pivoting element and the interchanging of rows and columns takes place to enhance the numerical stability. This method is not often used as it requires additional cost to find the maximal element and change the rows and columns. It provides numerical stability but accuracy is affected and decreased. In GAUSS ELIMINATION method the pivot value must not be zero so various steps are performed from 2-3 to remove zero as the pivot element. In the following example we perform various steps to remove zero as pivot element. [5]

4. CONCLUSION

The review paper helps us to gather knowledge about the Gauss Elimination Method and Gauss Jordan method with their formula and MATLAB code. The review paper helps us to know the method of solving questions using the two methods manually and using MATLAB code. The concept of pivoting helps us to know more about the errors in the Gauss Elimination method and how to resolve those errors such as approximation, etc.

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