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COMPUTIONAL TECHNIQUES FOR THE SOLUTIONS OF SYSTEM OF LINEAR EQUATIONS

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ABSTRACT

The MATLAB platform is optimized for solving engineering and scientific problems. The matrix-based MATLAB language is the world's most natural way to express computational mathematics. The purpose of this paper is to implement MATLAB on Gaussian elimination method, Gauss Jacobi iterative and Gaussian seidal iterative method through which their performance can be measured in order to find their relative importance and advantage in the field of symbolic and numeric computation. This paper also comprises of Rayleigh power method to find the largest Eigen value and corresponding Eigen vector through programming. A set of linear system of equations is perhaps the most widely applied numerical procedure when real world situations are to be stimulated.

Keywords: Computational Mathematics, Linear System of Equations, MATLAB, Numerical Procedure.

I. INTRODUCTION

Numerical methods require tedious and repetitive arithmetic operations .It is practical to solve problems when we have a computer to carry out these many separate operations. A computer program must be written so that the computer can do numerical analysis.A human mind would make so many mistakes that there would be little confidence in the result.Besides, the manpower cost would be more than could normally be afforded. The objective of the paper is to find the solutions of a set of linear system of equations using Toolboxes available from the developers of MATLAB. This paper explains how the MATLAB program can be very useful in doing numerical analysis as well as more analytic steps that are preliminary to the numerical method. Here Emphasis is given to the programming of Gauss Elimination method,Gauss Jacobi iterative method, Gauss Seidal iterative method and Rayleigh's power method.

II. PROGRAMMING

2.1 Gauss Elimination Method Program

Consider A= n x n matrix

B=Column vector

C= augmented matrix

C(2,:)=C(2,:)-C(1,:)/C(1,1)*C(2,1);

C(3,:)=C(3,:)-C(1,:)/C(1,1)*C(3,1);

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C(n,:)=C(n,:)-C(1,:)/C(1,1)*C(n,1);

C(n-1,:)=C(n-1,:)-C(n-2,:)/C(n-2,n-2)*C(n-1,n-2);

C(n,:)=C(n,:)-C(n-2,:)/C(n-2,n-2)*C(n,n-2);

C(n,:)=C(n,:)-C(n-1,:)/C(n-1,n-1)*C(n,n-1);

C

t=C(n,n+1)/C(n,n)

z=(C(n-1,n+1)-t*C(n-1,n))/C(n-1,n-1)

y=(C(n-2,n+1)-t*C(n-2,n)-Z*C(n-2,n-1))/C(n-2,n-2)

x=(C(1,n+1)-t*C(1,n)-Z*C(1,n-1)-y*C(1,n-2))/C(1,1)

2.2 Gauss Jacobi Iterative Method Program

Consider A= 3x3 matrix

B=Column vector

C= augmented matrix

```
Initialize x=0;y=0;z=0;
Initialize x1=x;y1=y;z1=z;
Initialize X=[x1;y1;z1];
Initialize j=0;
 Initialize s1=0;
Initialize s2=1;
while (s1~=s2)
   j
   xi=[17/20 -1/20 2/20]*[1;y;z]
   yi=[-18/20 -3/20 1/20]*[1;x;z]
   zi=[25/20 -2/20 3/20]*[1;x;y]
   Xi=[xi;yi;zi];
   s1=sum(X);
   s2=sum(Xi);
   y=yi;
   z=zi;
   x=xi;
   X=Xi
   j=j+1;
end
```

2.3 Gauss Seidal Iterative Method Program

Consider A= 3x3 matrix

B=Column vector

C= augmented matrix

```
Initialize y=0;z=0;
  Initialize y1=y;z1=z;
Initialize j=0;
 Initialize s1=0;
Initialize s2=1;
while (s1~=s2)
   j
   xi=[17/20 -1/20 2/20]*[1;y;z]
   yi=[-18/20 -3/20 1/20]*[1;x;z]
```

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```
    zi=[25/20 -2/20 3/20]*[1;x;y]
    Xi=[xi;yi;zi];
s1=sum(X);
    s2=sum(Xi);
    y=yi;
    z=zi;
    x=xi;
    X=Xi
    j=j+1;
end
```

2.4 Rayleigh Power Method To Find The Largest Eigen Value And Corresponding Eigen Vector

Consider A= n x n matrix

Initialize Eigen vector X= column vector
Initialize ei= column vector

```
Xp=X
while (1)
ei = A*Xp;
ci = max(ei(:));
ci
Xn = ei./ci;
Xn
if isequal(single(Xn),single(Xp))
break;
end
Xp=Xn
end
Xp
Ci
```

III. CONCLUSION

There are different direct and indirect methods which are used to compute the linear system of equations. Gaussian Elimination is a type of direct method used to calculate the unknown variables while Gauss Jacobi and Gauss Seidal are indirect methods. Many scientific and engineering domains of computation may take the form of linear equations. The equations in this field may contain large number of variables and hence it is important to solve these equations in an efficient manner. This paper comprises of Gaussian Elimination method, Gauss Jacobi iterative method, Gauss Seidal iterative method asefficient methods to solve these equations. It describes Rayleigh Power method to find the largest Eigen value and corresponding Eigen vector.Results of all sets of linear equations with the help of MATLAB are very satisfactory and the labour work is less.Like other programming we need not define multiple header files .MATLAB itself is rich with functions. The user, however, is not limited to the built-in functions; he can write his own functions in the MATLAB language. Also, for those who cannot do without their Fortran or C codes,MATLABeven provides an external interface to run those programs from within MATLAB. MATLAB is primarily a numerical computation package, although with the Symbolic Toolbox. It is often much faster at these calculations- often as fast as C or Fortran.. Linear systems are used in statistical analysis in many applications.The system of simultaneous linear equations arises, both directly in modelling physical situations and indirectly in the numerical solution of other mathematical models. Problems such as determining the potential in certain electrical networks, stresses in a building frame,

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flow rates in a hydraulic system etc., are all reduced to solving a set of algebraic equations simultaneously. Linear algebraic systems are also involved in the optimization theory, least squares fitting of data, numerical solution of boundary value problems for ordinary and partial differential equations, statistical inference etc. Linear systems are used in statistical analysis in many applications.

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