ICT Tool: - 'C' Language Program for Power Method

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Abstract – In Mathematics, Power method is used to find the dominant Eigen value and the corresponding eigen vector. Eigen value problems generally arise in dynamics problems and structural stability analysis. Power method is generally used to calculate these eigen value and corresponding eigen vector of the given matrix.

In the era of Information Communication Technology (ICT) .The ICT programming technique, it is easier task. One of the very popular programs in C programming is Power Method. This paper discuss Power Method in C language, source code and methods with outputs. The source codes of program for Lagrange's Interpolation in C programming are to be compiled. Running them on Turbo C or available version and other platforms might require a few modifications to the code.

Index Terms – Power Method, eigen vector, ICT, C Lang., Turbo C.

INTRODUCTION TO POWER METHOD

One of the very popular programs in C programming is Power Method, whereas a program in C can carry out the operations with short, simple and understandable codes. Power Method, used in mathematics and numerical methods, is an iteration method to compute the dominant eigenvalue and eigenvector of a matrix. It is a simple algorithm which does not compute matrix decomposition, and hence it can be used in cases of large sparse matrices. Power method gives the largest eigenvalue and it converges slowly.

POWER METHOD IS DEFINED AS

Assume that the n×n matrix A has n distinct eigenvalues $\lambda_1, \lambda_2, \lambda_3, \ldots, \lambda_n$ and that they are ordered in decreasing magnitude; that is, $|\lambda_1| > |\lambda_2| \geq |\lambda_3| \geq \ldots \geq |\lambda_n|$. If $\mathbf{X}_0$ is chosen appropriately, then the sequences $\left\{\mathbf{X}_k = \left(x_1^{(k)}, x_2^{(k)}, \ldots, x_n^{(k)}\right)^T\right\}$ and $\{c_k\}$ generated recursively by

$$\mathbf{Y}_k = \mathbf{A}\mathbf{X}_k$$

and

$$\mathbf{X}_{k+1} = \frac{1}{c_{k+1}}\mathbf{Y}_k$$

where $c_{k+1} = x_j^{(k)}$ and $x_j^{(k)} = \max_{1\leq i\leq n}\left\{\left|x_i^{(k)}\right|\right\}$, will converge to the dominant eigenvector $\mathbf{V}_1$ and eigenvalue λ_1, respectively. That is,

$$\lim_{k\to\infty}\mathbf{X}_k = \mathbf{V}_1 \quad \text{and} \quad \lim_{k\to\infty} c_k = \lambda_1 .$$

POWER METHOD CAN BE DESCRIBED AS

Let's look at a simple mathematical formulation of eigen values and eigen vector. For this, consider a matrix A. We have to find the column vector X and the constant L (L=lamda) such that:

[A]{X} = L{X}

Now, consider these three set of equations:

a11x1+a12x2+a13x3=Lx1
a12x1+a22x2+a23x3=Lx2
a31x1 + a32x2 + a33x3 = Lx3

These equations can be written as:

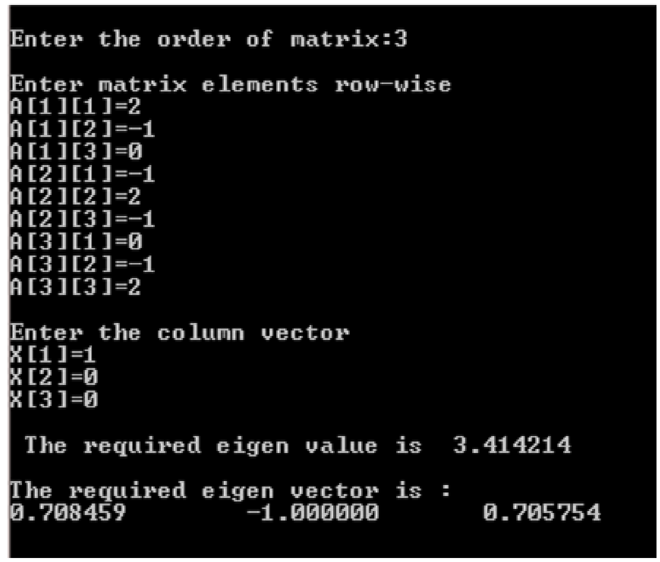
(a11-L)x1+a12x2+a13x3=0
a21x1+(a22-L)x2+a23x3=0
a31x1 +a32x2 + (a33-L)x3 = 0

C PROGRAM FOR POWER METHOD

```
#include<stdio.h>
#include<conio.h>
#include<math.h>
void main()
{
int i,j,n;
float A[40][40],x[40],z[40],e[40],zmax,emax;
printf("\n Enter the order of matrix: ");
scanf("%d", &n);
printf("\nEntre the matrix elements row-wise \n");
for(i=1;i<=n;i++)
{
        for(j=1;j<=n;j++)
        {
                printf("A[%d][%d]= ",i,j);
                scanf("%f", &A[i][j]);
        }
}
```

```
printf("\n Enter the column vector\n");
for(i=1;i<=n;i++)
{
        printf("X[%d]= ",i);
        scanf("%f",&x[i]);
}
do
{
        for(i=1;i<=n;i++)
        {
                z[i]=0;
                for(j=1;j<=n;j++)
                {
                        z[i] = z[i]+A[i][j]*x[j];
                }
        }
        zmax=fabs(z[1]);
        for(i=2;i<=n;i++)
        {
                if((fabs(z[i]))>zmax)
                        zmax = fabs(z[i]);
        }
        for(i=1;i<=n;i++)
        {
                z[i]=z[i]/zmax;
        }
        for(i=1;i<=n;i++)
        {
                e[i]=0;
                e[i]=fabs((fabs(z[i]))-(fabs(x[i])));
        }
        emax=e[1];
        for(i=2;i<=n;i++)
        {
                if(e[i]>emax)
                        emax =e[i];
        }
        for(i=1;i<=n;i++)
        {
                x[i]=z[i];
        }
}
while(emax>0.001);
printf("\n The required eigen value is %f",zmax);
printf("\n\n The required eigen vector is : \n");
for(i=1;i<=n;i++)
{
        printf("%f\t",z[i]);
}
getch();
}
```

OUTPUT OF POWER METHOD



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