Tema 2 - Calcul numeric - an I ID

Dinu Eugen Cosmin

Due May 15, 2021 10:00 AM

1. Se da matricea $A = \begin{bmatrix} 3 & -1 & -1 \\ -1 & 3 & -1 \\ 1 & -1 & 4 \end{bmatrix}$.

a) Determinati daca matricea este diagonal dominanta.

b) Rezolvati sistemul $Ax = b$ unde $b = \begin{bmatrix} 4 \\ 0 \\ 3 \end{bmatrix}$ folosig metoda Jacobi cu $x^{(0)} = 0$ pentru $\varepsilon = 0.05$.

c) Rezolvati sistemul $Ax = b$ unde $b = \begin{matrix} 4 \\ 0 \\ 3 \end{matrix}$ folosind metoda Gauss-Siedel cu $x^{(0)} = 0$ pentru $\varepsilon = 0.05$.

(a) Matricea este diagonal dominantă deoarece îndeplinește condiția: $|a_{ii}| \geq \sum_{j \neq i} |a_{ij}|$.

Cod octave: **isDiagonallyDominant.m**

```
function isDD = isDiagonallyDominant(matrix)
    for i=1:size(matrix,1)
      a = abs(matrix(i,i));
      sum = 0;
      for j=1:size(matrix,2)
        if i != j
          sum += abs(matrix(i,j));
        endif
      endfor
      if sum > a
        isDD = false;
        return
      else
        sum = 0;
        continue
      endif
    endfor
    isDD = true;
endfunction
```

Rezultat:

```
>> A = [3 -1 -1; -1 3 -1; 1 -1 4];
>> isDiagonallyDominant(A)
ans = 1
```

(b) Cod octave metoda Jacobi: **jacobi.m**

```
function x = jacobi(A,b,epsilon)
  [n, m] = size(A);
  x = rand(n,1);
  xnew = zeros(A,1);
  iter = 0;
  d = 0;
  diff=zeros(A,1);
  while d<n && iter<100000
    for i=1:n
      S=0;
      for j=1:n
        if i != j
          S=S+A(i,j)*x(j);
        endif
      endfor
      xnew(i)=(b(i)-S)/A(i,i);
    endfor
    for i=1:n
      diff(i)=abs(xnew(i)-x(i));
      if diff(i) <= epsilon
        d++;
      endif
    endfor
    x = xnew;
    iter ++;
  endwhile
  if d < n
    printf("nr de iteratii depasit\n");
  endif
endfunction

A = [3 -1 -1; -1 3 -1; 1 -1 4];
b = [4; 0; 3];
```

Rezultat:

```
jacobi(A,b,0.05)
ans =
   1.7365
   0.7398
   0.4975

   linsolve(A,b)
ans =
   1.7500
   0.7500
   0.5000
```

(c) Cod octave metoda Gauss-Siedel: **gauss.m**

```
function x = gauss(A,b,epsilon)
    [m, n] = size(A);
    x = zeros(n,1);
    normVal=Inf;
    while normVal>epsilon
      x_old=x;
      for i=1:n
        sigma=0;
        for j=1:i-1
          sigma=sigma+A(i,j)*x(j);
        endfor
        for j=i+1:n
          sigma=sigma+A(i,j)*x_old(j);
        endfor
        x(i)=(1/A(i,i))*(b(i)-sigma);
      endfor
      normVal=norm(x_old-x);
    endwhile
endfunction
```

Rezultat:

```
A = [3 -1 -1; -1 3 -1; 1 -1 4];
b = [4; 0; 3];
>> gauss(A,b,0.05)
ans =
   1.7524
   0.7514
   0.4997

>> linsolve(A,b)
ans =
   1.7500
   0.7500
   0.5000
```