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example 9.5

예제 9.5

$$\begin{bmatrix} 2.04 & -1 & & \\ -1 & 2.04 & -1 & \\ & -1 & 2.04 & -1 \\ & & -1 & 2.04 \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{Bmatrix} = \begin{Bmatrix} 40.8 \\ 0.8 \\ 0.8 \\ 200.8 \end{Bmatrix}$$

$f_2 = f_2 - \frac{e_2}{f_1} g_1 = 2.04 - \frac{-1}{2.04}(-1) = 1.550$

$r_2 = r_2 - \frac{e_2}{f_1} r_1 = 0.8 - \frac{-1}{2.04}(40.8) = 20.8$

$x_4 = \frac{r_4}{f_4} = \frac{20.996}{1.323} = 159.480$

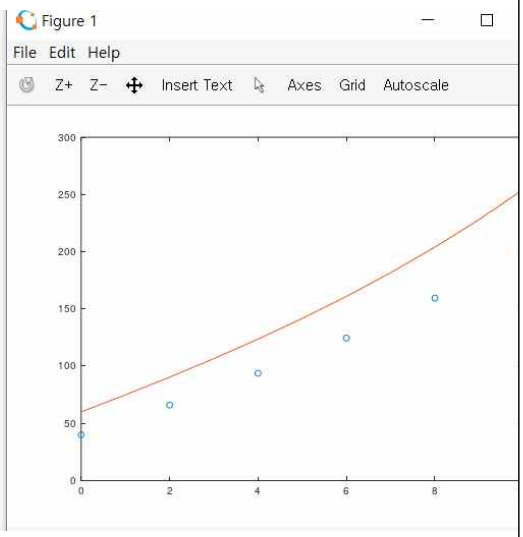
$x_3 = \frac{r_3 - g_3 x_4}{f_3} = \frac{14.224 - (-1)159.480}{1.395} = 124.538$

$x_2 = 93.778$

$x_1 = 65.970$

example 9.5 Case study

```
>> A = [2.04 -1 0 0
-1 2.04 -1 0
0 -1 2.04 -1
0 0 -1 2.04];
>> b = [40.8 0.8 0.8 200.8]';
>> T = (A\b)'
T =

    65.970    93.778   124.538   159.480

>> T=[40 T 200];
>> x[0:2:10];
parse error:

  syntax error

>>> x[0:2:10];
     ^

>> x=[0:2:10];
>> xanal=[0:10];
>> TT = @(x) 93.4523*exp(0.1*x)-53.4523*exp(-0.1*x)+20;
>> Tanal=TT(xanal);
>> plot(x,T,'o',xanal,Tanal)
>>
```




```
>> e = [0 -1 -1 -1];
>> f = [2.04 2.04 2.04 2.04];
>> g = [-1 -1 -1 0];
>> r = [40.8 0.8 0.8 200.8];
>> Tridiag(e,f,g,r)
error: 'Tridiag' undefined near line 1 column 1
>> Tridiag(e,f,g,r)
ans =

     0.00000     0.00000     0.00000   159.47952
```

example 10.1

예제 10.1

$$[A] = \begin{bmatrix} 3 & -0.1 & -0.2 \\ 0.1 & 7 & -0.3 \\ 0.3 & -0.2 & 10 \end{bmatrix} \qquad [U] = \begin{bmatrix} 3 & -0.1 & -0.2 \\ 0 & 7.00333 & -0.293333 \\ 0 & 0 & 10.0120 \end{bmatrix}$$

$$f_{21} = \frac{0.1}{3} = 0.0333333 \qquad f_{31} = \frac{0.3}{3} = 0.1$$

$$f_{32} = \frac{-0.19}{7.00333} = -0.0271300$$

$$[A] = [L][U] = \begin{bmatrix} 1 & 0 & 0 \\ 0.033333 & 1 & 0 \\ 0.1 & -0.02713 & 1 \end{bmatrix} \begin{bmatrix} 3 & -0.1 & -0.2 \\ 0 & 7.00333 & -0.29333 \\ 0 & 0 & 10.012 \end{bmatrix}$$

반올림 오차 때문에 곱하면 수가 약간 다름

example 10.2

예제 10.2

$$\begin{bmatrix} 3 & -0.1 & -0.2 \\ 0.1 & 7 & -0.3 \\ 0.3 & -0.2 & 10 \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \\ x_3 \end{Bmatrix} = \begin{Bmatrix} 7.85 \\ -19.3 \\ 71.4 \end{Bmatrix}$$

$$\Rightarrow \begin{bmatrix} 3 & -0.1 & -0.2 \\ 0 & 7.00333 & -0.293333 \\ 0 & 0 & 10.0120 \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \\ x_3 \end{Bmatrix} = \begin{Bmatrix} 7.85 \\ -19.5617 \\ 70.0843 \end{Bmatrix}$$

$$\Rightarrow \begin{bmatrix} 1 & 0 & 0 \\ 0.03333 & 1 & 0 \\ 0.1 & -0.02713 & 1 \end{bmatrix} \begin{Bmatrix} d_1 \\ d_2 \\ d_3 \end{Bmatrix} = \begin{Bmatrix} 7.85 \\ -19.3 \\ 71.4 \end{Bmatrix}$$

$$d_1 = 7.85 \quad , d_2 = -19.5617, \quad d_3 = 70.0843$$

$$\therefore x = \begin{Bmatrix} 3 \\ -2.5 \\ 7.000003 \end{Bmatrix}$$

example 10.4

```
>> A = [3 -.1 -.2;.1 7 -.3;.3 -.2 10];
>> b = [7.85; -19.3; 71.4];
>> [L,U] = lu(A)
L =

   1.00000   0.00000   0.00000
   0.03333   1.00000   0.00000
   0.10000  -0.02713   1.00000

U =

    3.00000   -0.10000   -0.20000
    0.00000    7.00333   -0.29333
    0.00000    0.00000   10.01204

>> L*U
ans =

    3.00000   -0.10000   -0.20000
    0.10000    7.00000   -0.30000
    0.30000   -0.20000   10.00000

>> d = L\b
d =

    7.8500
  -19.5617
   70.0843

>> x = U\d
x =

   3.0000
  -2.5000
   7.0000
```

example 10.5

예제 10.5

$$[A] = \begin{bmatrix} 6 & 15 & 55 \\ 15 & 55 & 225 \\ 55 & 225 & 979 \end{bmatrix}$$

$u_{11} = \sqrt{a_{11}} = \sqrt{6} = 2.44949$

$u_{12} = \frac{a_{12}}{u_{11}} = 6.123724$

$u_{13} = \frac{55}{2.44949} = 22.45366$

$a_{22} u_{22} = \sqrt{a_{22} - u_{12}^2} = \sqrt{55 - (6.123724)^2} = 4.1833$

$u_{23} = 20.9165$

$$\Rightarrow [U] = \begin{bmatrix} 2.44949 & 6.123724 & 22.45366 \\ & 4.1833 & 20.9165 \\ & & 6.110101 \end{bmatrix}$$

example 10.6

```
>> A = [6 15 55; 15 55 255; 55 255 979];
>> b = [sum(A(1,:)); sum(A(2,:)); sum(A(3,:))]
b =

    76
   325
  1289

>> U = chol(A)
U =

    2.44950    6.12370   22.45370
    0.00000    4.18330   20.91650
    0.00000    0.00000    6.11010

>> U'*U
ans =

     6.0001   15.0000   55.0003
    15.0000   54.9997  224.9997
    55.0003  224.9997  979.0019

>> d = U'\b
d =

   31.027
   32.272
  -13.531

>> x = U\d
x =

  -14.0005
   18.7866
   -2.2145
```

연습문제 10.6

```
>> A = [10 2 -1;-3 -6 2;1 1 5];
>> [L,U] = LUNaive(A)
L =

   1.00000   0.00000   0.00000
  -0.30000   1.00000   0.00000
   0.10000  -0.14815   1.00000

U =

   10.00000    2.00000   -1.00000
    0.00000   -5.40000    1.70000
    0.00000    0.00000    5.35185

>> L*U
ans =

   10.0000    2.0000   -1.0000
   -3.0000   -6.0000    2.0000
    1.0000    1.0000    5.0000

>> [L,U]=lu(A)
L =

   1.00000   0.00000   0.00000
  -0.30000   1.00000   0.00000
   0.10000  -0.14815   1.00000

U =

   10.00000    2.00000   -1.00000
    0.00000   -5.40000    1.70000
    0.00000    0.00000    5.35185
```

코드는 과제제출 첨부파일에 주어져있다.

연습문제 10.9

```
function x = Tridiag(e,f,g,r)
n = length(f);
for k = 2:n
  factor = e(k)/f(k-1);
  f(k) = f(k) - factor*g(k-1);
  r(k) = r(k) - factor*r(k-1);
end
x(n) = r(n) / f(n);
for k = n:1-1:-1
  x(k) = (r(k)-g(k)*x(k+1))/f(k);
end
```

```
>> clear
>> A = [8 20 16;20 80 50;16 50 60];
>> cholesky(A)
ans =

   2.82843   7.07107   5.65685
   0.00000   5.47723   1.82574
   0.00000   0.00000   4.96655

>> U = chol(A)
U =

   2.82843   7.07107   5.65685
   0.00000   5.47723   1.82574
   0.00000   0.00000   4.96655
```