

1.13N

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OPIS

Opracowane przy pomocy programu Matlab.

Cały kod z Matlabu znajduje się pod tym linkiem <http://wklej.org/hash/3a7da590aa5/> lub na dole tego pliku.

Zdecydowałem się tam wrzucić kod aby zaoszczędzić panu udręki w czytaniu wszystkiego w tym pliku.

Wykaz komend jakimi się posługiwałem:

$\text{cond}(A)$ – oblicza współczynnik uwarunkowania macierzy A

$\text{inv}(A)$ – oblicza A^{-1}

$\text{norm}()$ – do normowania wektorów, liczenia ich długości.

WYNIKI

$\|b1 - b2\| = 0.0099999889523588344591738914923705$

$\|b3 - b4\| = 0.010000003094494578309158765850944$

$\|z1 - z2\|/\|b1 - b2\| = 0.0015951766720442647377972004813857$

$\|z3 - z4\|/\|b3 - b4\| = 1003.7641153863729084581286157872$

Współczynnik uwarunkowania macierzy A :

803011.2902183193685431463519897

INTERPRETACJA

Jak widzimy długości wektorów $b1 - b2$ oraz $b3 - b4$ nie różnią się znacznie. Ale niewielkie zmiany które je wyróżniają mają kolosalne znaczenie na dalsze wyniki.

Obliczając poszczególne wektory z_i z podanego wzoru przy użyciu wektorów $b1, b2, b3$ i $b4$ zauważamy, że tak naprawdę niewielkie różnice wektorów $b3$ i $b4$ powodują dużą rozbieżność w wynikach wektorów $z3$ i $z4$ skąd dalsze iloraz różnią się tak bardzo. Spowodowane to jest dużym współczynnikiem uwarunkowania macierzy A , który mówi że macierz jest źle uwarunkowana.

KOD

```
>> format longeng
>> helpA = [-116.66654 583.33346 -333.33308 100.00012 100.00012; 583.33346 -
116.66654 -333.33308 100.00012 100.00012; -333.33308 -333.33308 133.33383
200.00025 200.00025; 100.00012 100.00012 200.00025 50.000125 -649.99988;
100.00012 100.00012 200.00025 -649.99988 50.000125]
```

```
helpA =
```

```

-116.666540000000e+000    583.333460000000e+000    -333.333080000000e+000
100.000120000000e+000    100.000120000000e+000
    583.333460000000e+000    -116.666540000000e+000    -333.333080000000e+000
100.000120000000e+000    100.000120000000e+000
-333.333080000000e+000    -333.333080000000e+000    133.333830000000e+000
200.000250000000e+000    200.000250000000e+000
    100.000120000000e+000    100.000120000000e+000    200.000250000000e+000
50.000125000000e+000    -649.999880000000e+000
    100.000120000000e+000    100.000120000000e+000    200.000250000000e+000
-649.999880000000e+000    50.000125000000e+000
```

```
>> A = vpa(helpA,8)
```

```
A =
```

```
[ -116.66654, 583.33346, -333.33308, 100.00012, 100.00012]
[ 583.33346, -116.66654, -333.33308, 100.00012, 100.00012]
[ -333.33308, -333.33308, 133.33383, 200.00025, 200.00025]
[ 100.00012, 100.00012, 200.00025, 50.000125, -649.99988]
[ 100.00012, 100.00012, 200.00025, -649.99988, 50.000125]
```

```
>> Ainvh = inv(A)
```

```
Ainvh =
```

```
[ 125.470165897268682189258457323, 125.47159446869725361794589287169,
250.94051036595556012447067230703, 125.47066949706761596123828533079,
125.47066949706761596123828533079]
[ 125.47159446869725361794589287169, 125.470165897268682189258457323,
250.94051036595556012447067230703, 125.47066949706761596123828533079,
125.47066949706761596123828533079]
[ 250.94051036595556012447067230703, 250.94051036595556012447067230703,
501.88227073190599388320085494156, 250.94133899415089790643581222507,
250.94133899415089790643581222507]
[ 125.47066949706761596123828533079, 125.47066949706761596123828533079,
250.94133899415089790643581222507, 125.47075643020827999771582047878,
125.46932785878991265062039235477]
[ 125.47066949706761596123828533079, 125.47066949706761596123828533079,
250.94133899415089790643581222507, 125.46932785878991265062039235477,
125.47075643020827999771582047878]
```

```
>> Ainv = vpa(Ainvh,8)
```

```
Ainv =
```

```
[ 125.47017, 125.47159, 250.94051, 125.47067, 125.47067]
[ 125.47159, 125.47017, 250.94051, 125.47067, 125.47067]
[ 250.94051, 250.94051, 501.88227, 250.94134, 250.94134]
[ 125.47067, 125.47067, 250.94134, 125.47076, 125.46933]
[ 125.47067, 125.47067, 250.94134, 125.46933, 125.47076]
```

```
>> format long
```

```
>> b1h = [-0.33388066; 1.08033290; -0.98559856; 1.31947922; -0.09473435]
```

```
b1h =
```

```
-0.3338806600000000
 1.0803329000000000
-0.9855985600000000
 1.3194792200000000
-0.0947343500000000
```

```
>> b1 = vpa(b1h,8)
```

```
b1 =
```

```
-0.33388066
 1.0803329
-0.98559856
 1.3194792
-0.09473435
```

```
>> b2h = [-0.33388066; 1.08033290; -0.98559855; 1.32655028; -0.10180541]
```

```
b2h =
```

```
-0.3338806600000000
 1.0803329000000000
-0.9855985500000000
 1.3265502800000000
-0.1018054100000000
```

```
>> b2 = vpa(b2h,8)
```

```
b2 =
```

```
-0.33388066
 1.0803329
-0.98559855
 1.3265503
-0.10180541
```

```
>> b3h = [0.72677951; 0.72677951; -0.27849178; 0.96592583; 0.96592583]
```

```
b3h =
```

```
0.7267795100000000
0.7267795100000000
-0.2784917800000000
0.9659258300000000
0.9659258300000000
```

```
>> b3 = vpa(b3h,8)
```

```
b3 =
```

```
0.72677951  
0.72677951  
-0.27849178  
0.96592583  
0.96592583
```

```
>> b4h = [0.73031505; 0.73031505; -0.27142071; 0.96946136; 0.96946136]
```

```
b4h =
```

```
0.730315050000000  
0.730315050000000  
-0.271420710000000  
0.969461360000000  
0.969461360000000
```

```
>> b4 = vpa(b4h,8)
```

```
b4 =
```

```
0.73031505  
0.73031505  
-0.27142071  
0.96946136  
0.96946136
```

```
>> z1h = Ainv *b1
```

```
z1h =
```

```
0.0019828595502702032704902911649648  
-0.000037445535444082500915554584502103  
-0.00021964946867945860156442368305683  
0.00024055098067071176060857737240983  
-0.0017797541048985378304421934047329
```

```
>> z1 = vpa(z1h,8)
```

```
z1 =
```

```
0.0019828596  
-0.000037445535  
-0.00021964947  
0.00024055098  
-0.0017797541
```

```
>> z2h = Ainv * b2
```

```
z2h =
```

```
0.0019853689553742831953700151420206  
-0.000034936130340002576035830607446384
```

```
-0.00021463064597129874025914397167636  
0.00025316190827463429113713699369198  
-0.0017873462057217363992947999902047
```

```
>> z2 = vpa(z2h,8)
```

```
z2 =
```

```
0.001985369  
-0.00003493613  
-0.00021463065  
0.00025316191  
-0.0017873462
```

```
>> z3h = Ainv * b3
```

```
z3h =
```

```
354.88518138061214840494870320888  
354.88518138061214840494870320888  
709.76819769774090715057590551226  
354.88343241795752390145000702125  
354.88343241795752390145000702125
```

```
>> z3 = vpa(z3h,8)
```

```
z3 =
```

```
354.88518  
354.88518  
709.7682  
354.88343  
354.88343
```

```
>> z4h = Ainv * b4
```

```
z4h =
```

```
358.43402455894378819401757680299  
358.43402455894378819401757680299  
716.86588405439168788765910592574  
358.43227552975252141429932688161  
358.43227552975252141429932688161
```

```
>> z4 = vpa(z4h,8)
```

```
z4 =
```

```
358.43402  
358.43402  
716.86588  
358.43228  
358.43228
```

```
>> blodejmijb2 = b1 - b2
```

```
blodejmijb2 =
```

```

0
0
-0.000000010000000050247592753294156864285
  -0.0070710599999999068643319333205
    0.0070710600000000040088465880216972

>> norm(b1odejmijb2)

ans =

0.0099999889523588344591738914923705

>> b3odejmijb4 = b3 - b4

b3odejmijb4 =

-0.0035355400000000036797587199544068
-0.0035355400000000036797587199544068
-0.00707107000000000126230759178724838
  -0.0035355300000000064454468429175904
    -0.0035355300000000064454468429175904

>> norm(b3odejmijb4)

ans =

0.010000003094494578309158765850944

>> z1odejmijz2 = z1 - z2

z1odejmijz2 =

-0.0000025094051040799248797239770557189
-0.0000025094051040799248797239770557188
-0.0000050188227081598613052797113804627
  -0.000012610927603922530528559621282146
    0.00000759210082319856885260658547181

>> norm(z1odejmijz2)

ans =

0.000015951749097503178991334993443723

>> z3odejmijz4 = z3 - z4

z3odejmijz4 =

-3.5488431783316397890688735941024
-3.5488431783316397890688735941024
-7.0976863566507807370832004134842
  -3.5488431117949975128493198603663
    -3.5488431117949975128493198603663

>> norm(z3odejmijz4)

```

```
ans =  
10.037644260006342049001101585957  
>> z1z2b1b2 = norm(z1odejmijz2)/norm(b1odejmijb2)  
z1z2b1b2 =  
0.0015951766720442647377972004813857  
>> z3z4b3b4 = norm(z3odejmijz4)/norm(b3odejmijb4)  
z3z4b3b4 =  
1003.7641153863729084581286157872  
>> cond(A)  
ans =  
803011.2902183193685431463519897  
>>
```