
```
import numpy as np
import numpy.linalg as la
import math, time
import matplotlib.pyplot as plt
from sys import argv
import datetime
%matplotlib inline
```

```
k = 100
```

```
eps = 10E-6
times = np.array([[0.,0.]])
temp_times = times
H = np.random.rand(k+200,k+200)
H = H.T.dot(H)
file = datetime.datetime.now().strftime("%Y%m%d%H%M%S")
```

```
for i in range(k):
```

```
    # print i
    i = i+2
    n = i
    err = 1
    conv = 1
    int_H = H[0:n,0:n]
```

```
    start = time.clock()
```

```
    phi0 = np.random.rand(n)
    # print la.eig(H)[1].T
    CayleyN = (np.identity(n)-0.5*int_H)
    CayleyP = (np.identity(n)+0.5*int_H)
```

```
    while(conv > eps):
```

```
        phi1 = la.solve(CayleyP,CayleyN.dot(phi0))
        mu = math.sqrt(phi1.dot(phi1))
        phi1 = phi1/mu
        conv = math.sqrt((np.abs(phi1)-np.abs(phi0)).dot(np.abs(phi1)-np.abs(phi0)))
        # err = math.sqrt(2)*math.sqrt(abs(phi1.dot(int_H.dot(int_H)).dot(phi1)- (phi1.dot(int_H
        # print err
        phi0 = phi1
```

```
    end = time.clock()
```

```
    delta_t = end-start
```

```
    temp_times[0][0] = i
```

```
    temp_times[0][1] = delta_t
```

```
    times = np.concatenate((times,temp_times),axis=0)
```

```

np.savetxt(file,times,fmt='%.4e')

plt.plot(times[:k,0],times[:k,1])

plt.show()

```

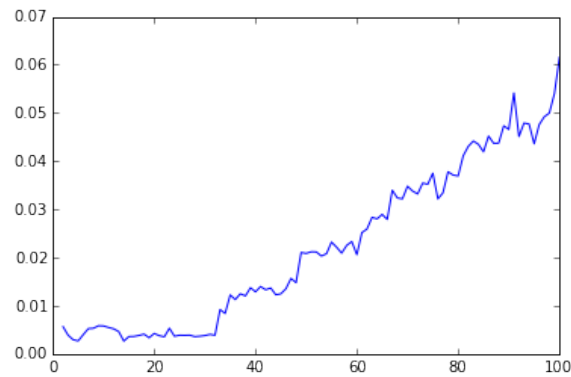


Figure 1: Times for $n = 100$

```

np.set_printoptions(precision=6)
phi0

```

```

array([-0.094935, -0.096057, -0.10178 , -0.099219, -0.097089, -0.097033,
       -0.098758, -0.104216, -0.098332, -0.097018, -0.102402, -0.096239,
       -0.098734, -0.105752, -0.099294, -0.100605, -0.101216, -0.093854,
       -0.097984, -0.099754, -0.096319, -0.098788, -0.099517, -0.09842 ,
       -0.101383, -0.105324, -0.101146, -0.101833, -0.094279, -0.097077,
       -0.097832, -0.102189, -0.102742, -0.10125 , -0.097857, -0.101754,
       -0.100668, -0.098891, -0.093873, -0.099995, -0.095826, -0.103389,
       -0.100639, -0.094354, -0.098921, -0.100959, -0.102625, -0.106157,
       -0.100221, -0.09968 , -0.095368, -0.104255, -0.102345, -0.098933,
       -0.100639, -0.09618 , -0.100753, -0.096752, -0.102995, -0.093164,
       -0.101365, -0.101131, -0.099828, -0.09559 , -0.101657, -0.097293,
       -0.10002 , -0.096943, -0.102959, -0.102501, -0.097684, -0.093914,
       -0.096335, -0.095506, -0.102979, -0.100255, -0.100033, -0.099462,
       -0.102459, -0.100797, -0.098398, -0.101093, -0.094854, -0.100054,
       -0.099324, -0.096936, -0.100831, -0.100929, -0.103075, -0.107075,
       -0.096951, -0.097061, -0.101106, -0.097536, -0.093412, -0.096506,
       -0.098778, -0.105925, -0.098345, -0.100835, -0.101887])

```

```
la.eig(int_H)[1][:,0]
```

```
array([ 0.094901,  0.096054,  0.101784,  0.099226,  0.097091,  0.097019,  
        0.098775,  0.104224,  0.098339,  0.097043,  0.102389,  0.096238,  
        0.09873 ,  0.105752,  0.099307,  0.100582,  0.101227,  0.093873,  
        0.09798 ,  0.099759,  0.096307,  0.098795,  0.099518,  0.098437,  
        0.101374,  0.105338,  0.101133,  0.101838,  0.094252,  0.09706 ,  
        0.097823,  0.102193,  0.102714,  0.101276,  0.097868,  0.101753,  
        0.100663,  0.09891 ,  0.09388 ,  0.099994,  0.095805,  0.103364,  
        0.100643,  0.094369,  0.098931,  0.100959,  0.102622,  0.106174,  
        0.100243,  0.099674,  0.095381,  0.104265,  0.102324,  0.098944,  
        0.100633,  0.096196,  0.100745,  0.096736,  0.102986,  0.093154,  
        0.101371,  0.101129,  0.09984 ,  0.095591,  0.101671,  0.097308,  
        0.099997,  0.096957,  0.102969,  0.102503,  0.097694,  0.09391 ,  
        0.096317,  0.0955 ,  0.102999,  0.100234,  0.100048,  0.099462,  
        0.102462,  0.100784,  0.098383,  0.101065,  0.094856,  0.100061,  
        0.099326,  0.096941,  0.100824,  0.100938,  0.103075,  0.107076,  
        0.096965,  0.09706 ,  0.101094,  0.097551,  0.093412,  0.096509,  
        0.098747,  0.105936,  0.098345,  0.100809,  0.101897])
```