Ruído Rosa

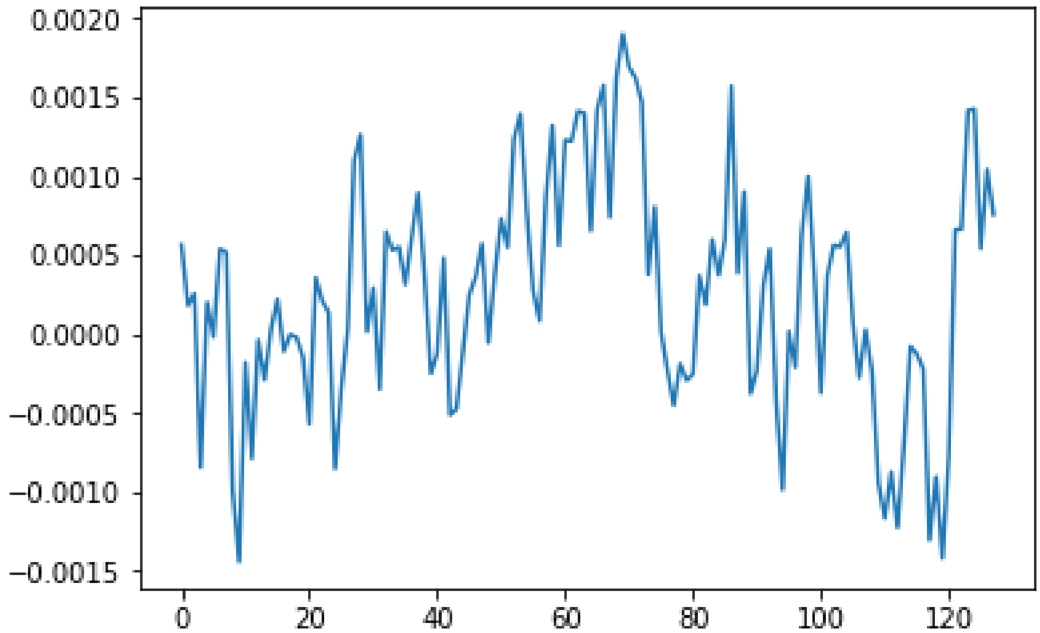
27 de maio de 2018

```
In [1]: from scipy.stats import moment
        from scipy.stats import kurtosis, skew, scoreatpercentile
        from scipy.stats import norm, lognorm, beta
        from scipy.optimize import minimize

        from numpy import zeros, fromiter, savetxt, loadtxt
        from IPython.display import Image

        import subprocess

        import numpy as np
        import pandas as pd
        import matplotlib.pyplot as plt
        import seaborn as sns

        import auxiliar_matcomp as aux

        #%matplotlib inline

        size = 2**12
        t = fromiter((i for i in range(0,size)), int, size)
```

1 Série Completa

1.1 Gerando série temporal e plotando resultado

```
In [2]: name = "A.ex:1.3.b"

        A = loadtxt("noise_equals_1.txt")

        savetxt(name + ".txt", A)

        save_A = A

In [3]: num_points = 128
        plt.plot(t[0:num_points], A[0:num_points])
        plt.show()
```



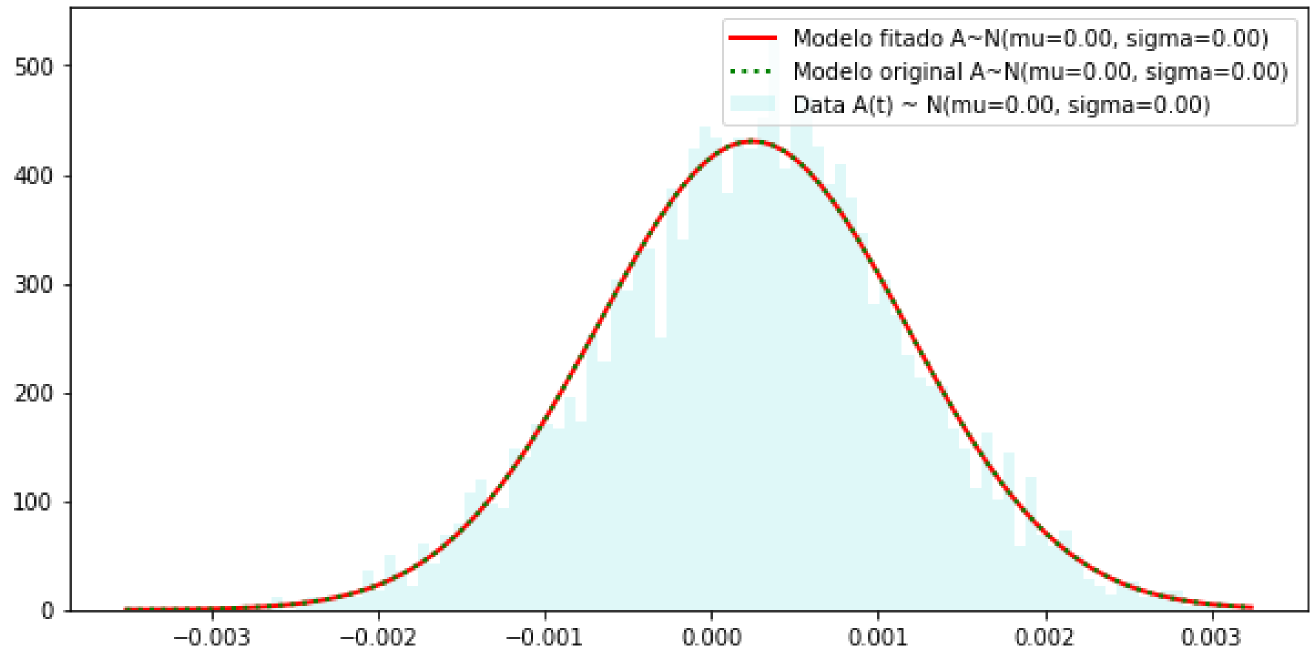
1.2 Calculando os momentos do ensemble

```
In [4]: A_mean, A_var, A_skew, A_kurtosis = aux.calcMoments(A)

        print("mean : ", A_mean)
        print("var  : ", A_var)
        print("skew : ", A_skew)
        print("kurt : ", A_kurtosis)

        A_Q1 = scoreatpercentile(A, 25)
        A_Q3 = scoreatpercentile(A, 75)

        print("Q1   : ", A_Q1)
        print("Q3   : ", A_Q3)
```

```
mean :  0.000244138427734
var  :  8.58551688601e-07
skew :  -0.0935099523351
kurt :  0.0896515440478
Q1   :  -0.00036925
Q3   :  0.00085
```

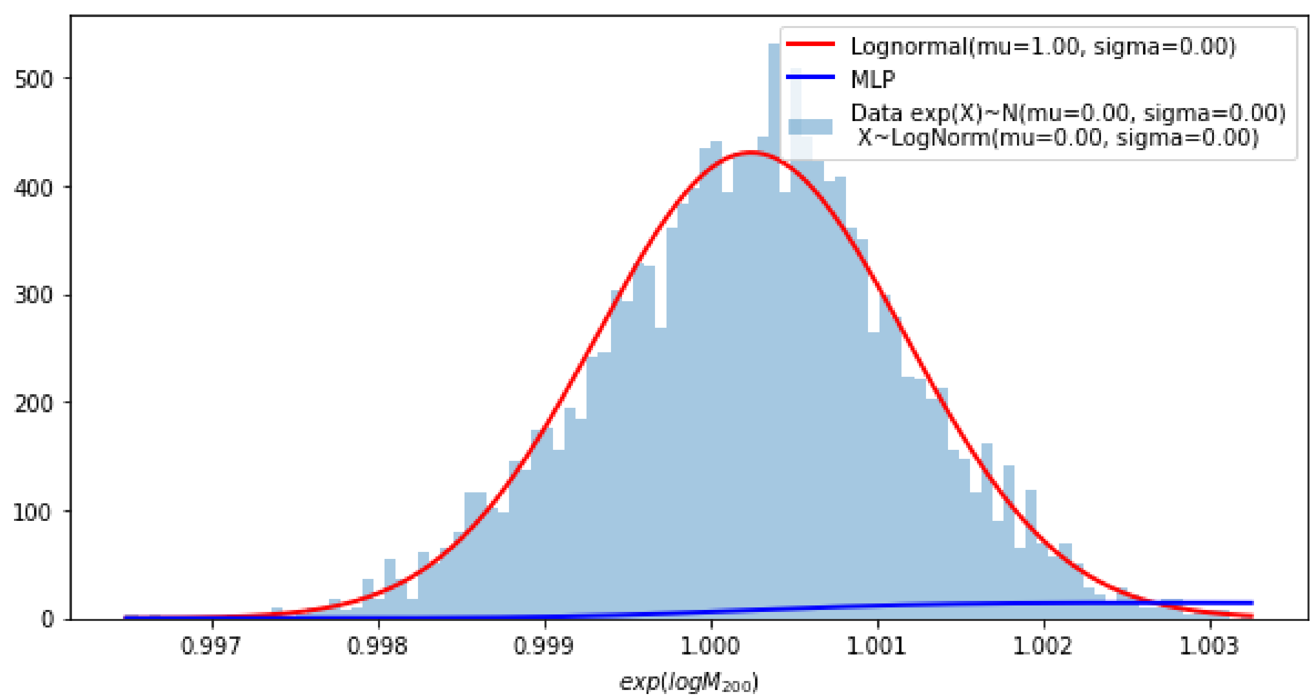
1.3 Fitando uma distribuição normal

```
In [5]: aux.fitting_normal_distribution(A)
```



1.4 Fitando uma distribuição lognormal

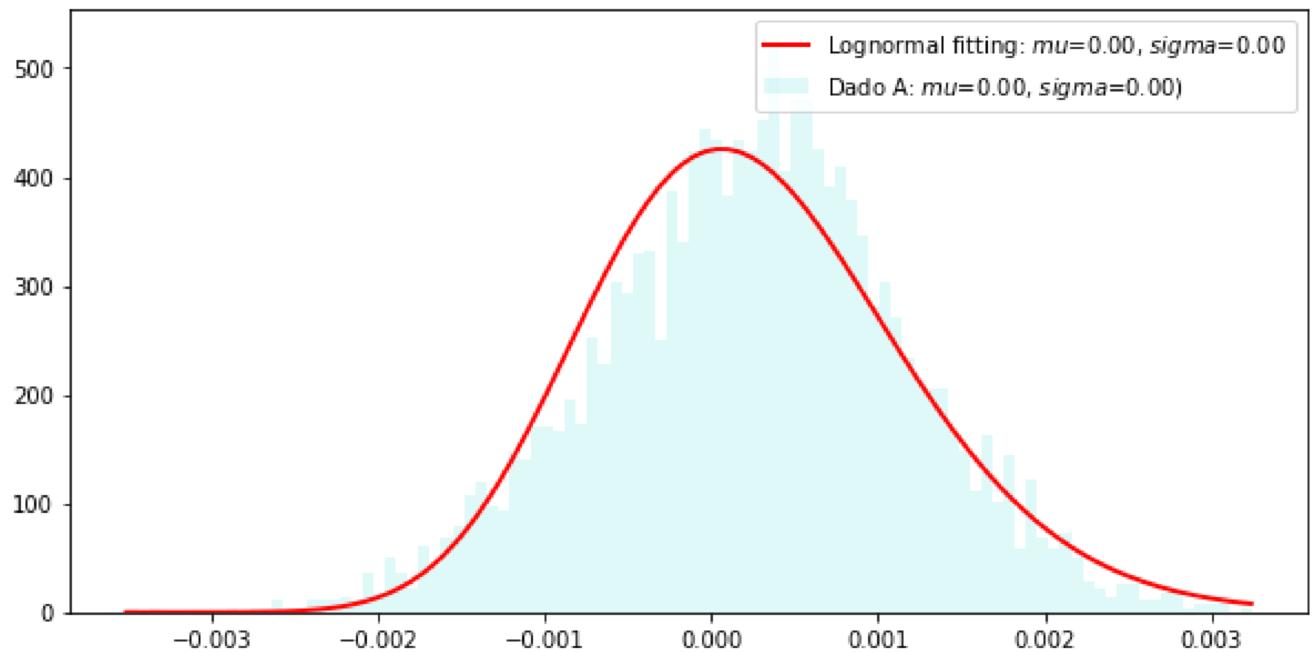
```
In [6]: aux.fitting_lognormal_and_mlp_distribution(A)
```



1.5 Fitando uma distribuição lognormal (utlizando minha implementação)

```
In [7]: aux.fitting_lognormal_distribution(A)
```

```
parametros de fitting:  (0.13071356411666873, -0.0070480477939303572, 0.0072314132330994754)
        Fitado                         Original
mean :  0.0002454081707660878          0.000244138427734
var  :  9.166921486879154e-07          8.58551688601e-07
skew :  0.3960839243133013            -0.09350995233510521
kurt :  0.2802107469047588            0.08965154404783382
```

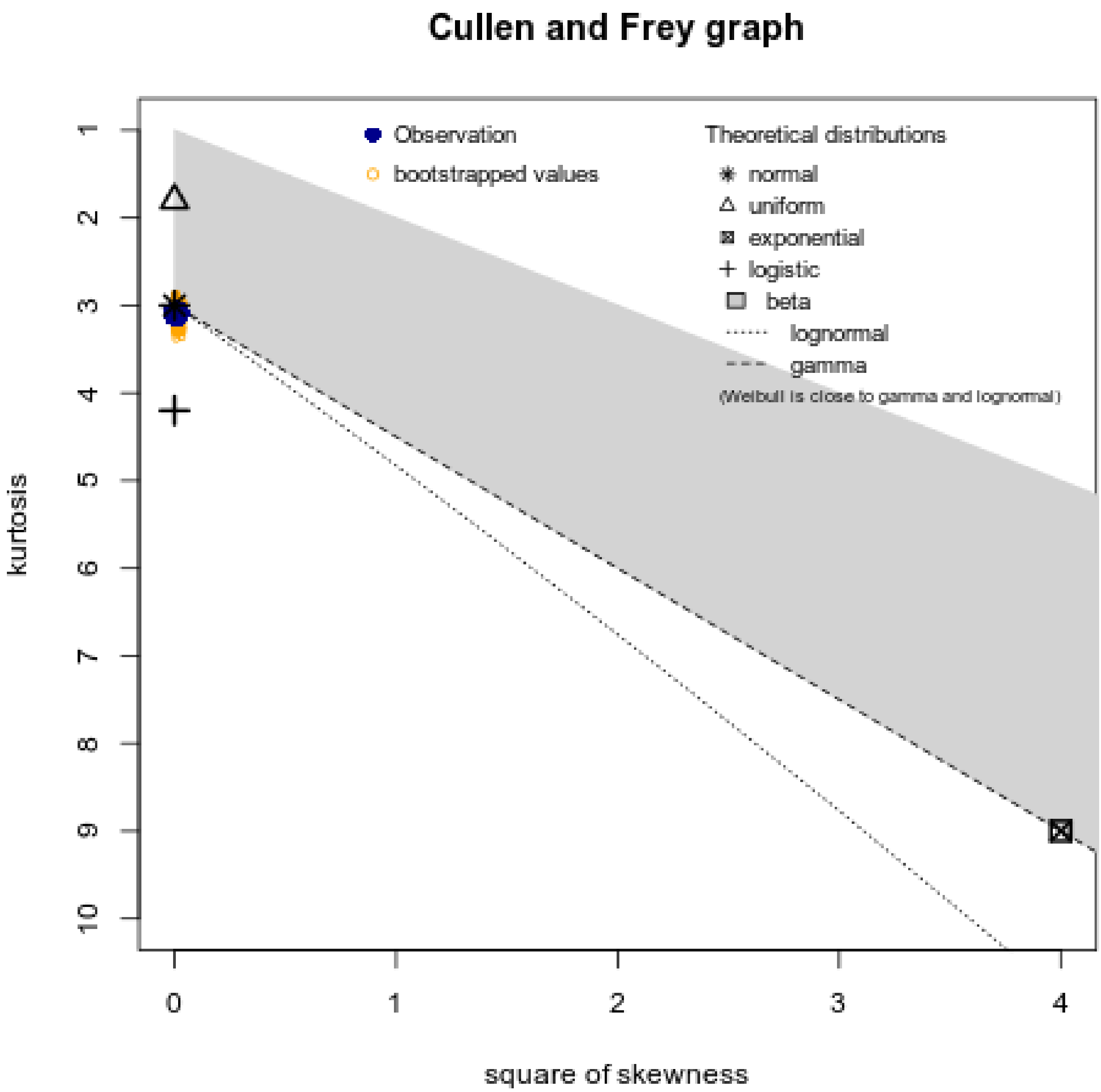


1.6 Plotando dados no espaço de Cullen-Frey

In [8]:
```python
command = 'Rscript'
path_script = 'cullen_frey_script.R'

# define arguments
args = [name,]

# build subprocess command
cmd = [command, path_script] + args

x = subprocess.check_output(cmd, universal_newlines=True)
print(x)

Image(name+".png")
```

```
summary statistics
------
min:  -0.003515   max:  0.003241
median:  0.000275
mean:  0.0002441384
estimated sd:  0.0009266938
estimated skewness:  -0.09354421
estimated kurtosis:  3.091227
```

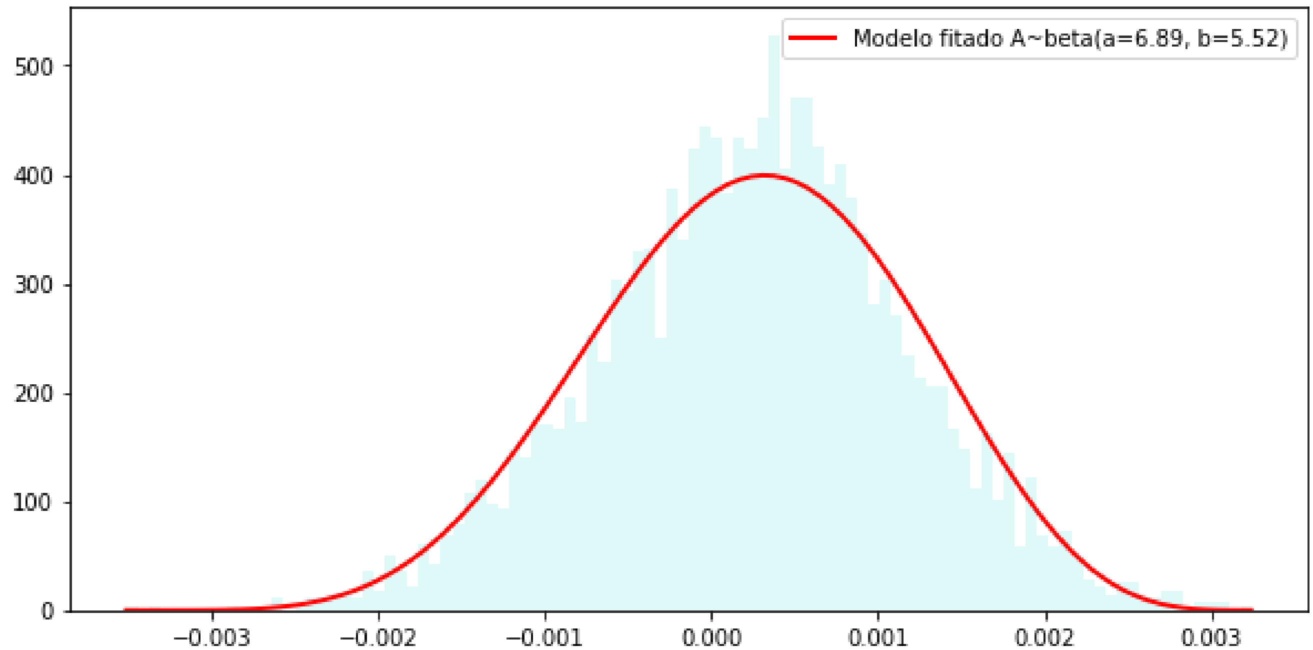
Out[8]:



1.7 Fitando melhor distribuição segundo método de Cullen-Frey

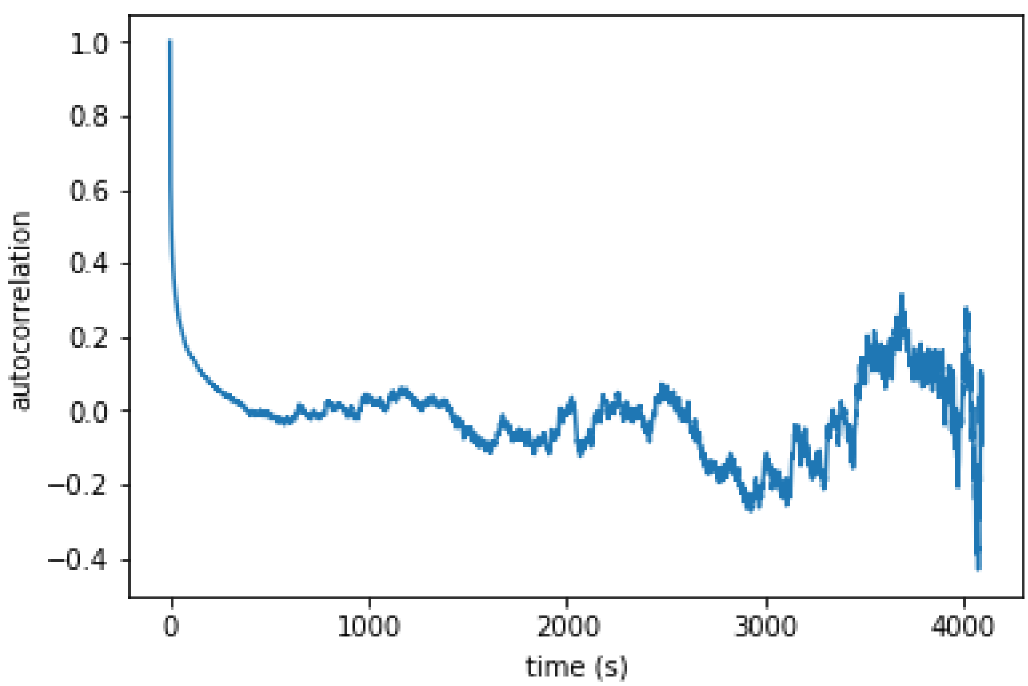
```
In [9]: aux.fitting_beta_distribution(A)
```

```
parametros de fitting:  (6.8872790152682954, 5.5222449533439733, -0.0036149999999999997, 0.00695599999999
        Fitado                         Original
mean :  0.00024557619545930885          0.000244138427734
var  :  8.91166568078e-07           8.58551688601e-07
skew :  -0.11249905095316202          -0.09350995233510521
kurt :  -0.3716175022973669          0.08965154404783382
```



1.8 Calculando autocorrelação

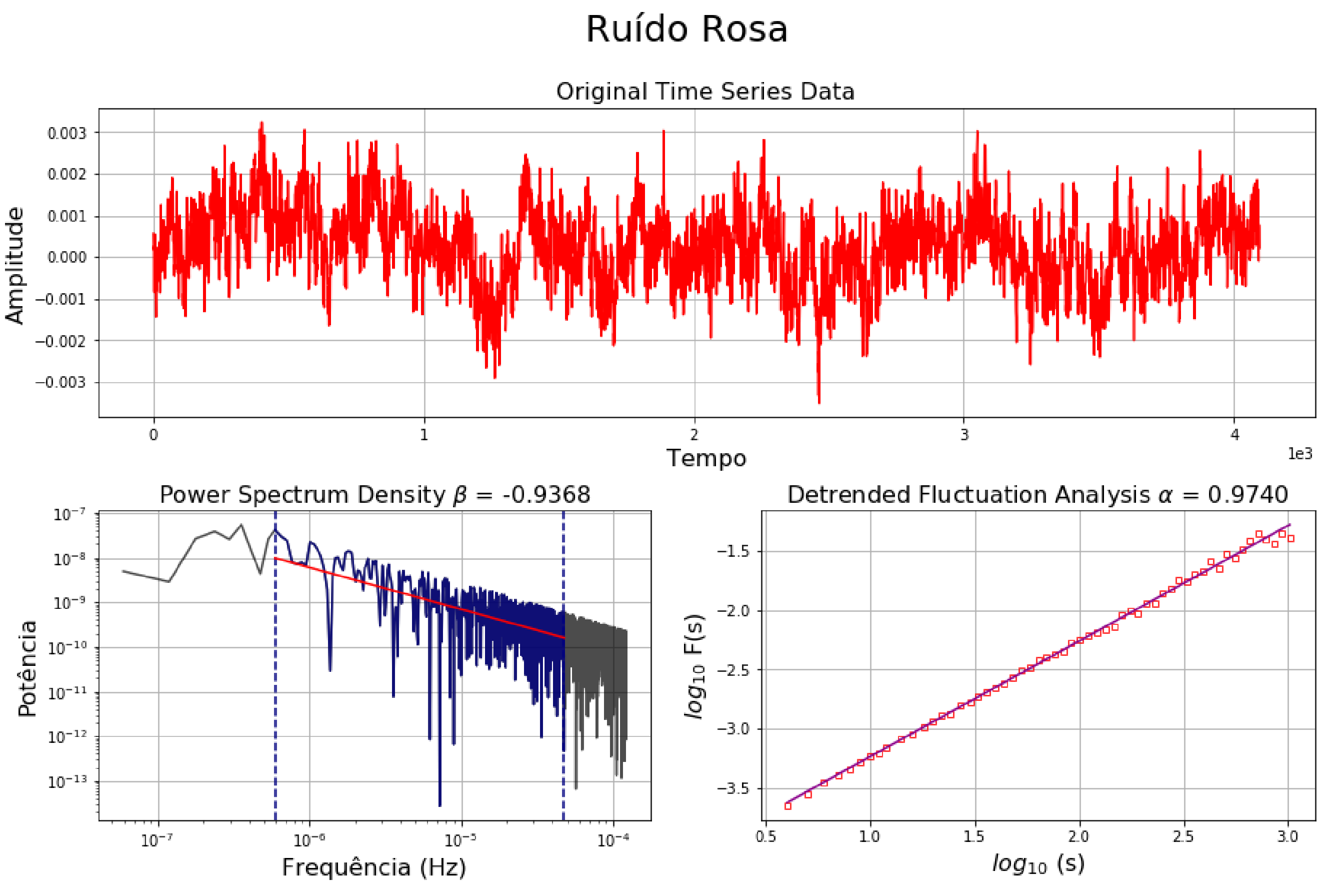
```
In [10]: aux.plot_estimated_autocorrelation(t, A, 0, len(A))
```



1.9 Plotando DFA e PSD

```
In [11]: aux.plot_psd_dfa(A, 'Ruído Rosa')
```

```
Original time series data (4096 points):

First 10 points: [  5.65000000e-04   1.79000000e-04   2.55000000e-04  -8.45000000e-04
   1.99000000e-04  -1.70000000e-05   5.40000000e-04   5.17000000e-04
  -9.90000000e-04  -1.44200000e-03]


1. Plotting time series data...
2. Plotting Power Spectrum Density...
3. Plotting Detrended Fluctuation Analysis...
```



2 Analise dos primeiros 1024 pontos

```
In [12]: A = save_A[1024:]
         name = "A.ex:1.3.b"
         savetxt(name + ".txt", A)
```

2.1 Calculando os momentos do ensemble

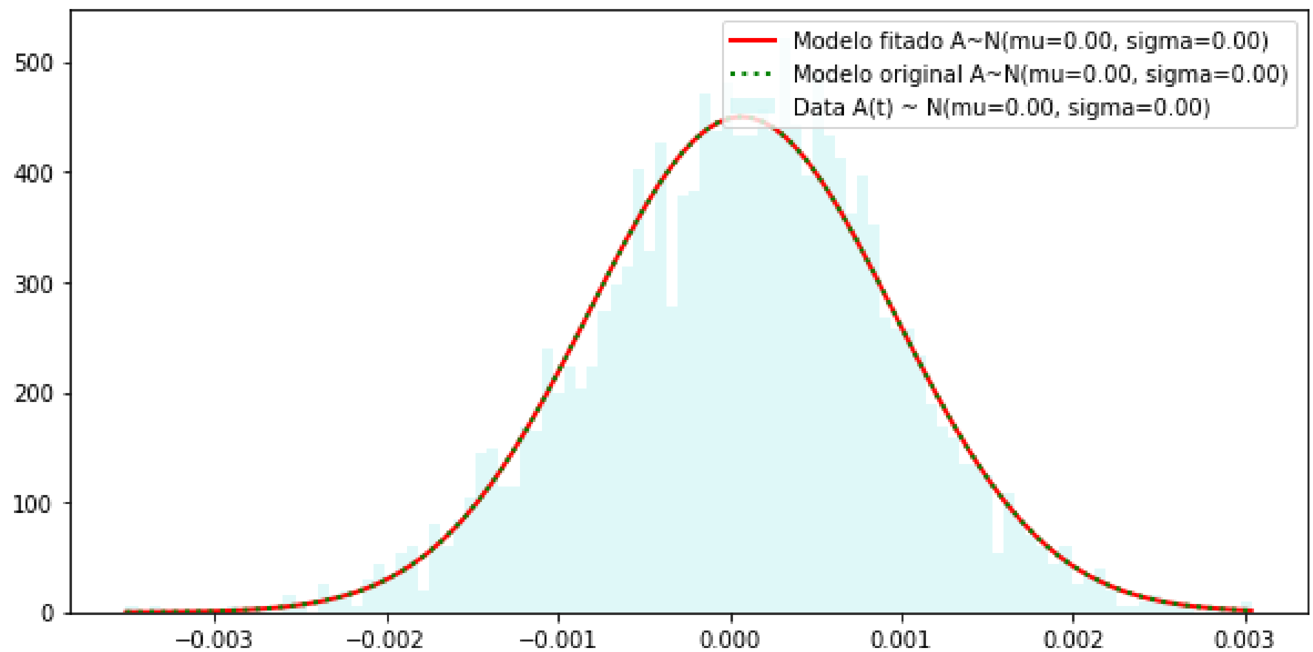
```
In [13]: A_mean, A_var, A_skew, A_kurtosis = aux.calcMoments(A)

         print("mean : ", A_mean)
         print("var  : ", A_var)
         print("skew : ", A_skew)
         print("kurt : ", A_kurtosis)
```

```
A_Q1 = scoreatpercentile(A, 25)
A_Q3 = scoreatpercentile(A, 75)

print("Q1   : ", A_Q1)
print("Q3   : ", A_Q3)
```

```
mean :  6.72652994792e-05
var  :  7.85688368744e-07
skew :  -0.139844021357
kurt :  0.106960696185
Q1   :  -0.000522
Q3   :  0.00066375
```

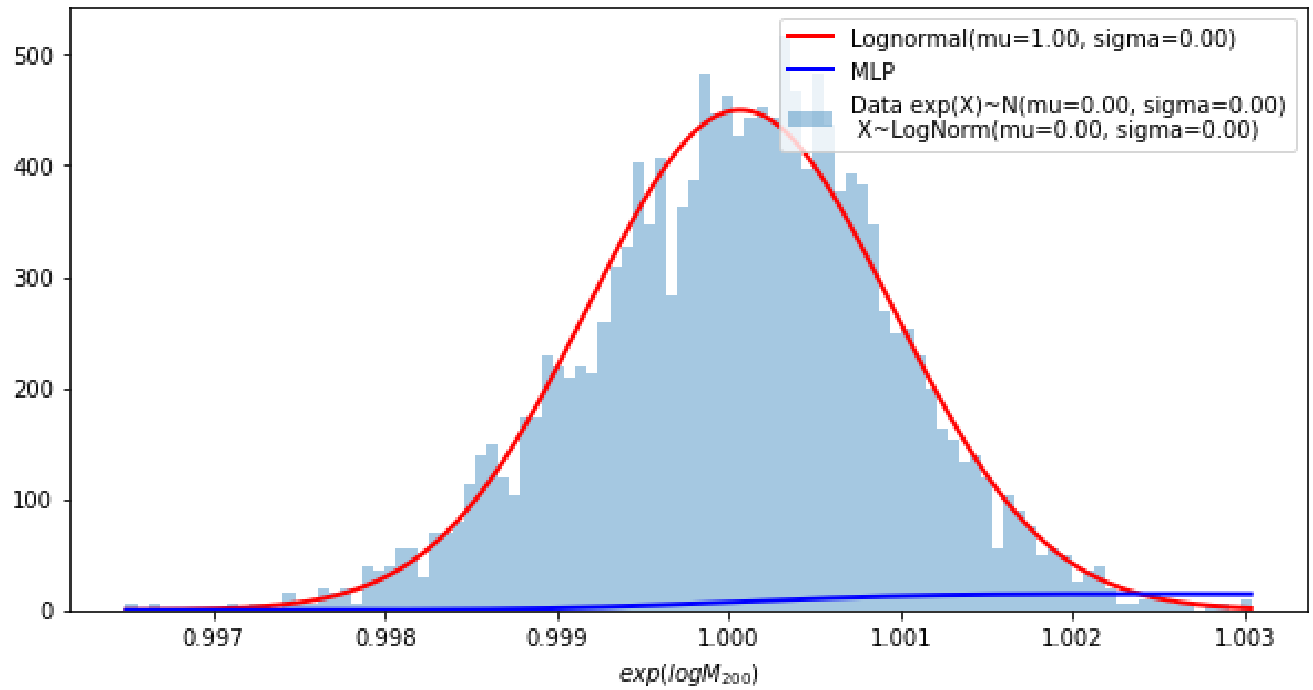
2.2 Fitando uma distribuição normal

In [14]: `aux.fitting_normal_distribution(A)`



2.3 Fitando uma distribuição lognormal

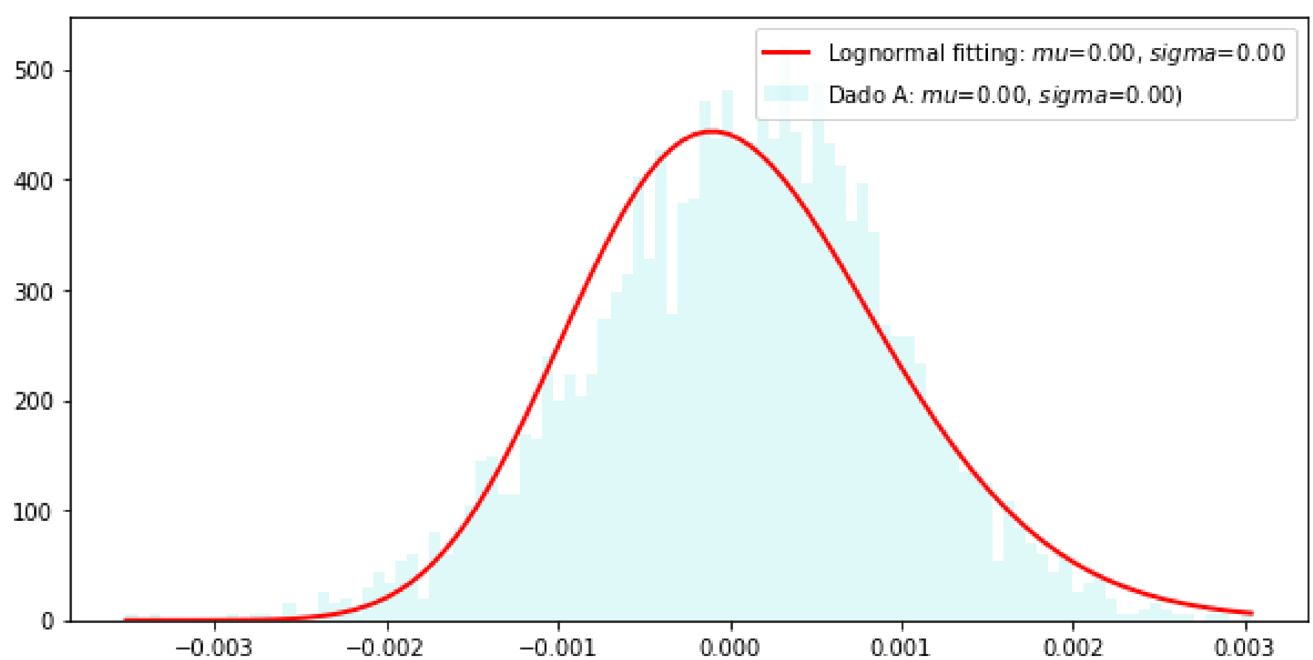
In [15]: `aux.fitting_lognormal_and_mlp_distribution(A)`



2.4 Fitando uma distribuição lognormal (utlizando minha implementação)

```
In [16]: aux.fitting_lognormal_distribution(A)
```

```
parametros de fitting:  (0.12728142579988691, -0.0071082415072294194, 0.007119030503917519)
        Fitado                         Original
mean :  6.868932979979623e-05          6.72652994792e-05
var  :  8.412600040768991e-07          7.85688368744e-07
skew :  0.3854833048687238          -0.13984402135746263
kurt :  0.2653475025269669          0.10696069618538662
```

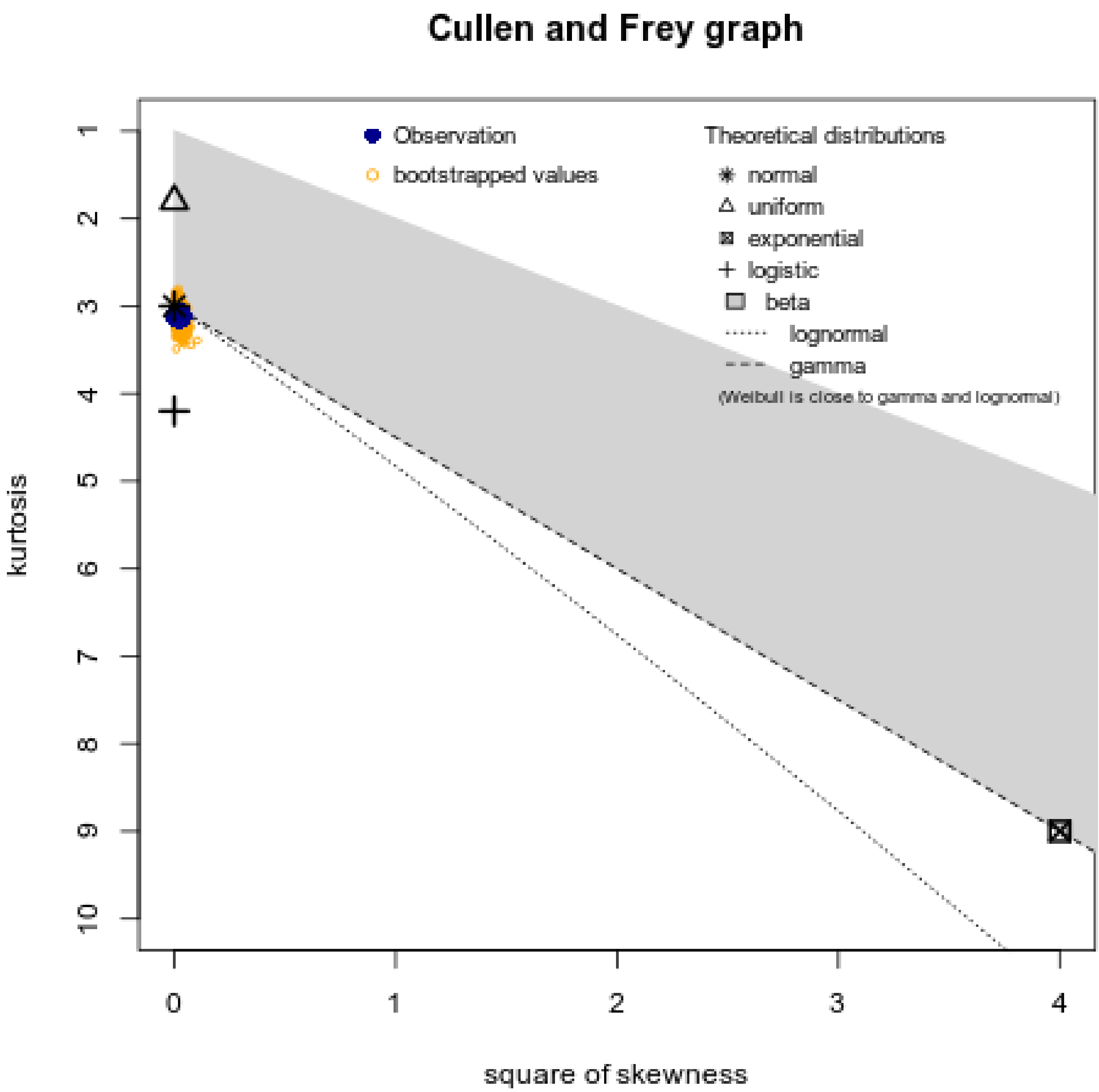


2.5 Plotando dados no espaço de Cullen-Frey

In [17]:
```
command = 'Rscript'
path_script = 'cullen_frey_script.R'

# define arguments
args = [name,]

# build subprocess command
cmd = [command, path_script] + args

x = subprocess.check_output(cmd, universal_newlines=True)
print(x)


Image(name+".png")
```

```
summary statistics
------
min:  -0.003515   max:  0.003036
median:  0.0001045
mean:  6.72653e-05
estimated sd:  0.0008865349
estimated skewness:  -0.1399123
estimated kurtosis:  3.109091
```

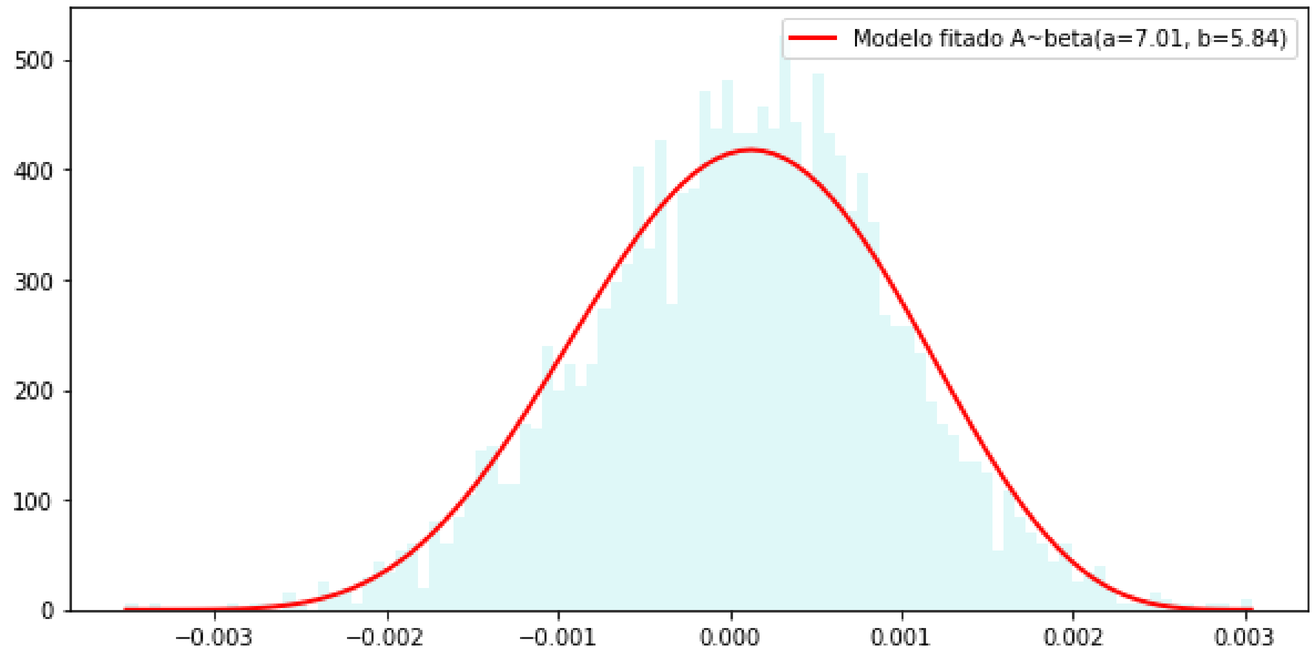
Out[17]:



2.6 Fitando melhor distribuição segundo método de Cullen-Frey

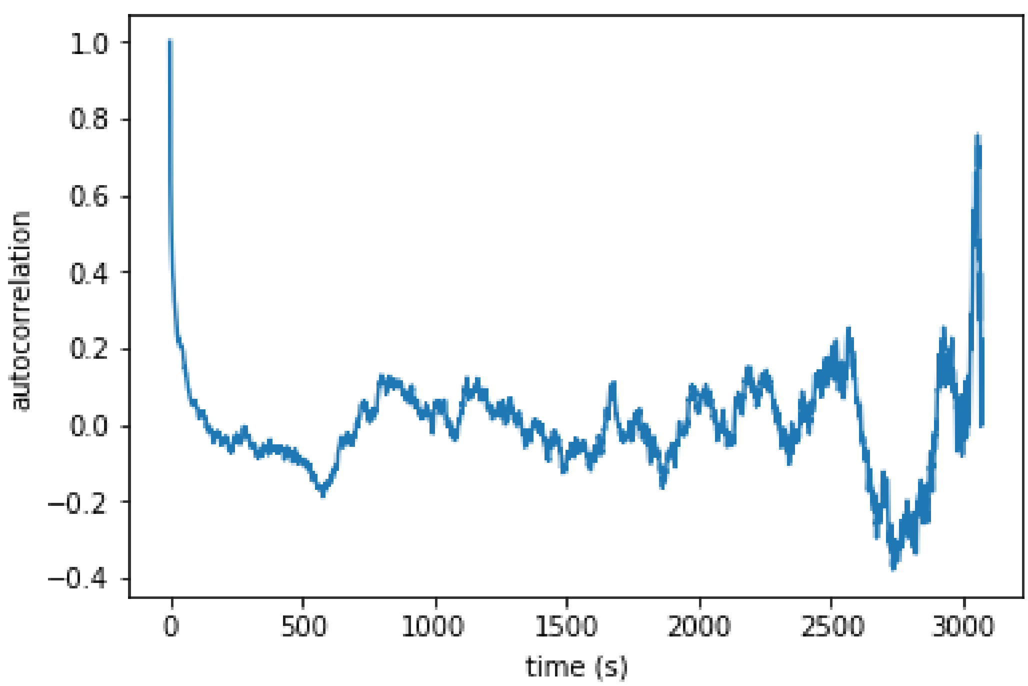
```
In [18]: aux.fitting_beta_distribution(A)
```

```
parametros de fitting:  (7.006461608771855, 5.840843456434146, -0.0036149999999999997, 0.00675099999999999
        Fitado                          Original
mean :  6.6754428710637 33e-05           6.72652994792e-05
var  :  8.160583176064381e-07           7.85688368744e-07
skew :  -0.09133434933275673           -0.13984402135746263
kurt :  -0.3668899199974081           0.10696069618538662
```



2.7 Calculando autocorrelação

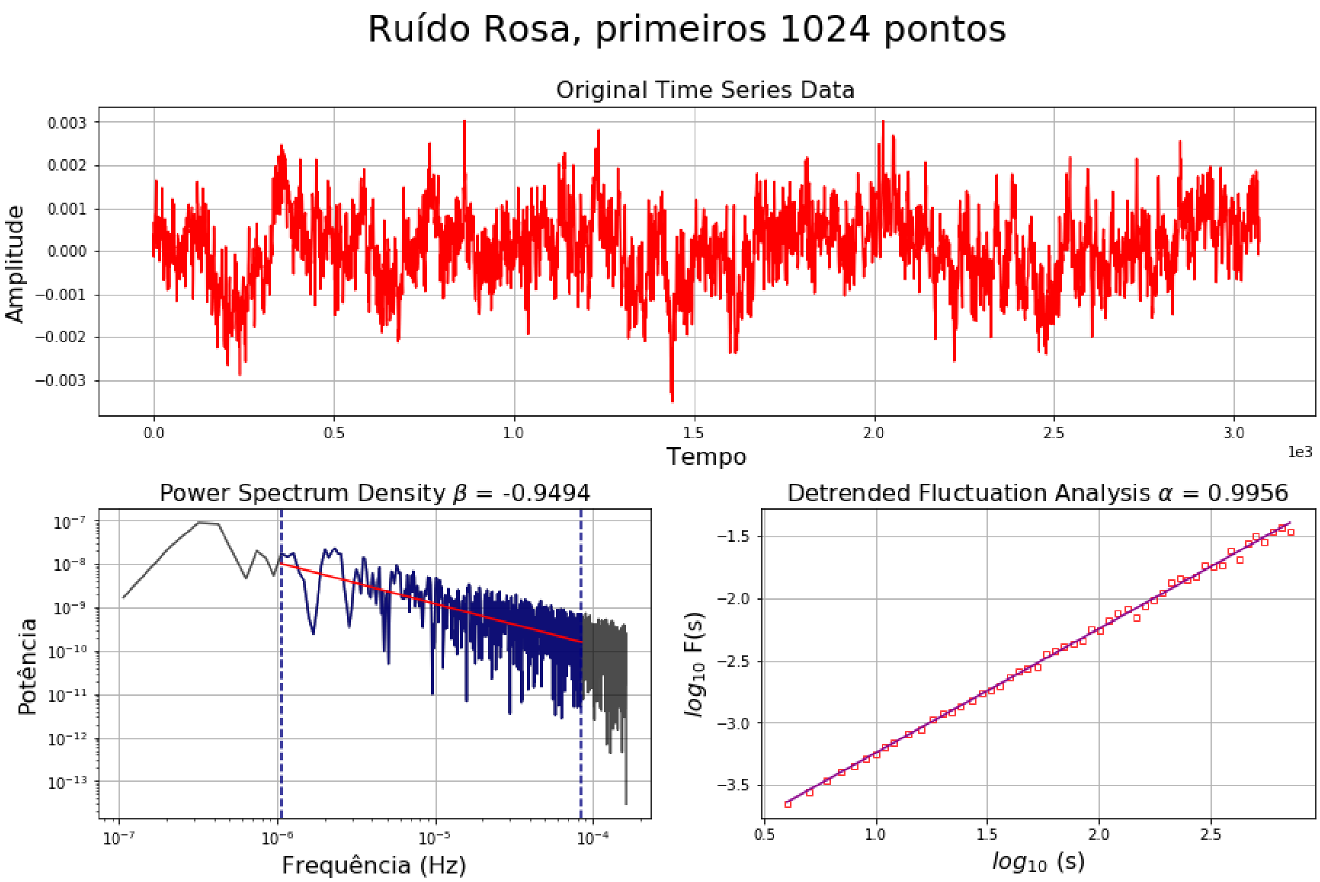
```
In [19]: aux.plot_estimated_autocorrelation(t, A, 0, len(A))
```



2.8 Plotando DFA e PSD

```
In [20]: aux.plot_psd_dfa(A, 'Ruído Rosa, primeiros 1024 pontos')
```

```
Original time series data (3072 points):

First 10 points: [  6.52000000e-04  -1.36000000e-04   3.85000000e-04   1.98000000e-04
   8.50000000e-04   8.75000000e-04   1.23300000e-03   1.64300000e-03
   1.02000000e-03   5.10000000e-05]


1. Plotting time series data...
2. Plotting Power Spectrum Density...
3. Plotting Detrended Fluctuation Analysis...
```



3 Analise dos últimos 1024 pontos

```
In [21]: A = save_A[3*1024:4096]
         name = "A.ex:1.3.b"
         savetxt(name + ".txt", A)
```

```
In [22]: A.shape
```

```
Out[22]: (1024,)
```

3.1 Calculando os momentos do ensemble

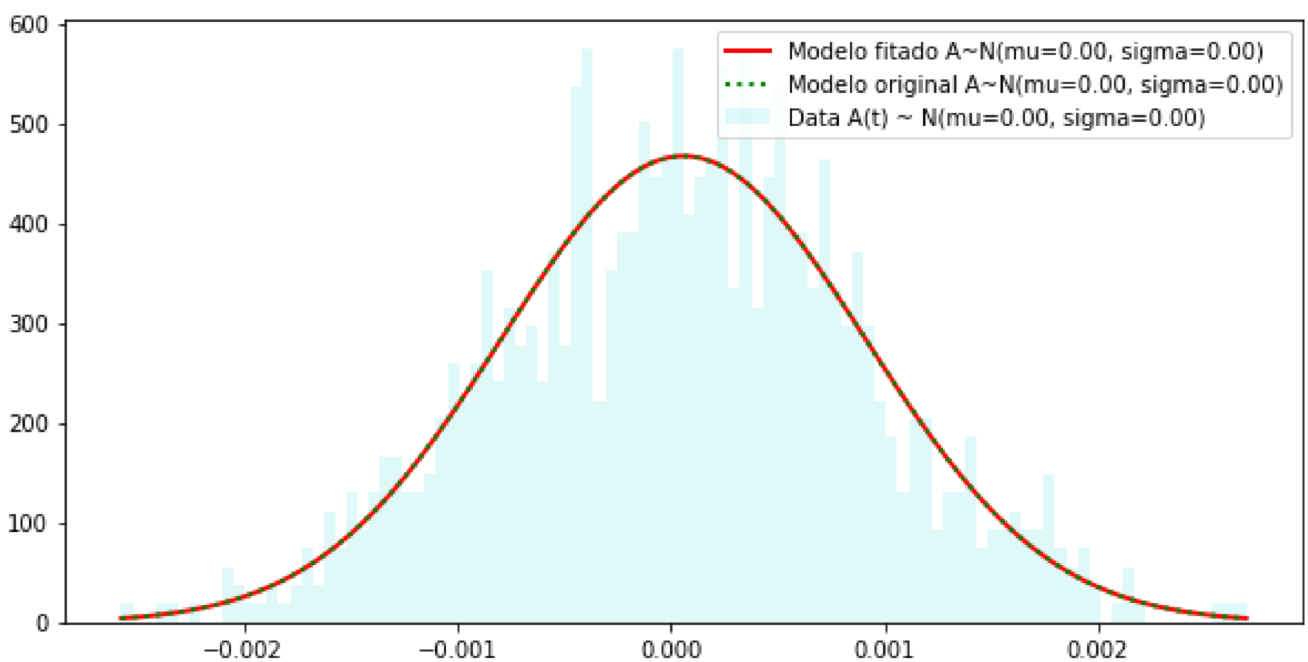
```
In [23]: A_mean, A_var, A_skew, A_kurtosis = aux.calcMoments(A)
```

```
        print("mean : ", A_mean)
        print("var  : ", A_var)
        print("skew : ", A_skew)
        print("kurt : ", A_kurtosis)

        A_Q1 = scoreatpercentile(A, 25)
        A_Q3 = scoreatpercentile(A, 75)

        print("Q1   : ", A_Q1)
        print("Q3   : ", A_Q3)
```

```
mean :  5.81640625e-05
var  :  7.28789928162e-07
skew :  -0.00513776542445
kurt :  -0.110061013972
Q1   :  -0.000515
Q3   :  0.00062825
```

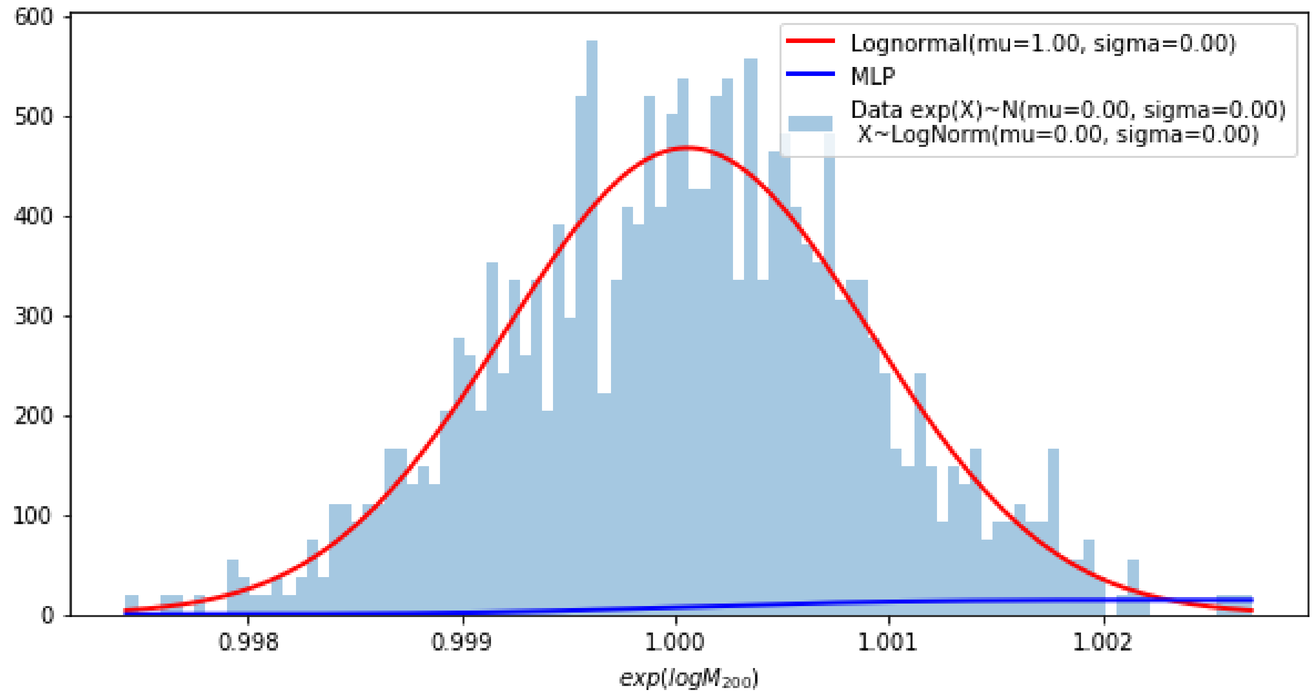
3.2 Fitando uma distribuição normal

```
In [24]: aux.fitting_normal_distribution(A)
```



3.3 Fitando uma distribuição lognormal

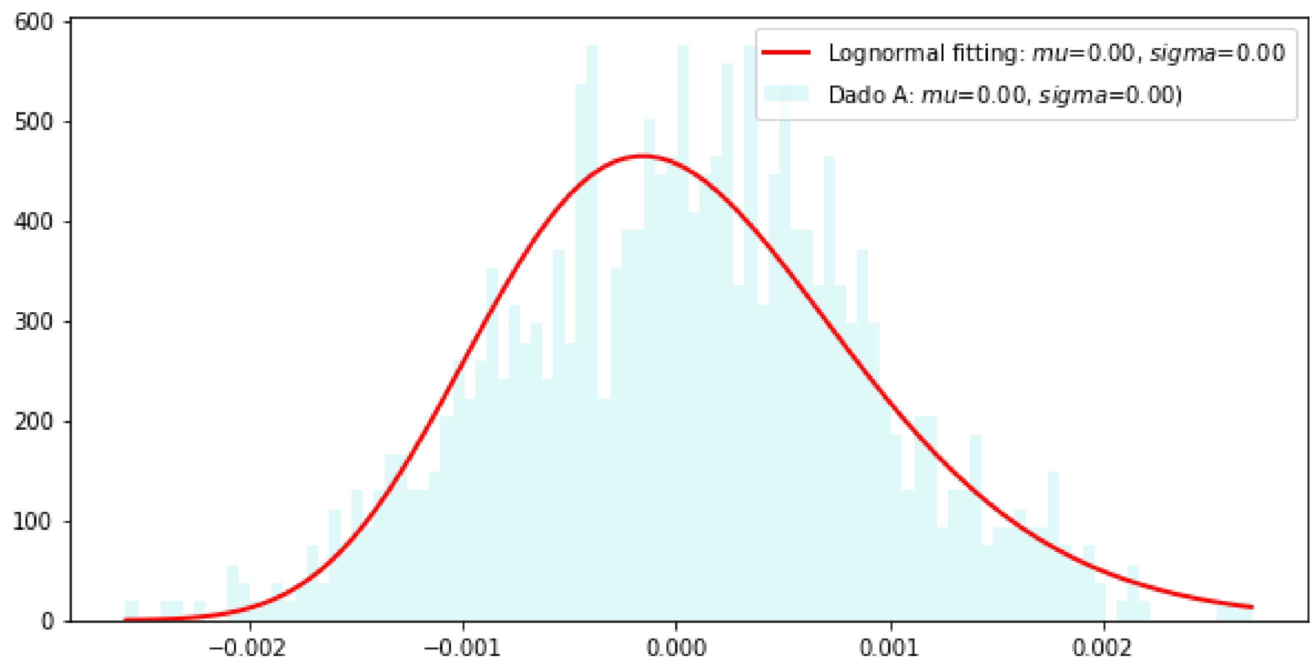
```
In [25]: aux.fitting_lognormal_and_mlp_distribution(A)
```



3.4 Fitando uma distribuição lognormal (utlizando minha implementação)

In [26]: aux.fitting_lognormal_distribution(A)

```
parametros de fitting:  (0.16643915126032455, -0.0052453091862056465, 0.0052325298376193295)
        Fitado                         Original
mean :  6.020065492408702e-05          5.81640625e-05
var  :  7.906686716525222e-07          7.28789928162e-07
skew :  0.5075032337975492            -0.005137765424454573
kurt :  0.4613968390263903            -0.11006101397202306
```

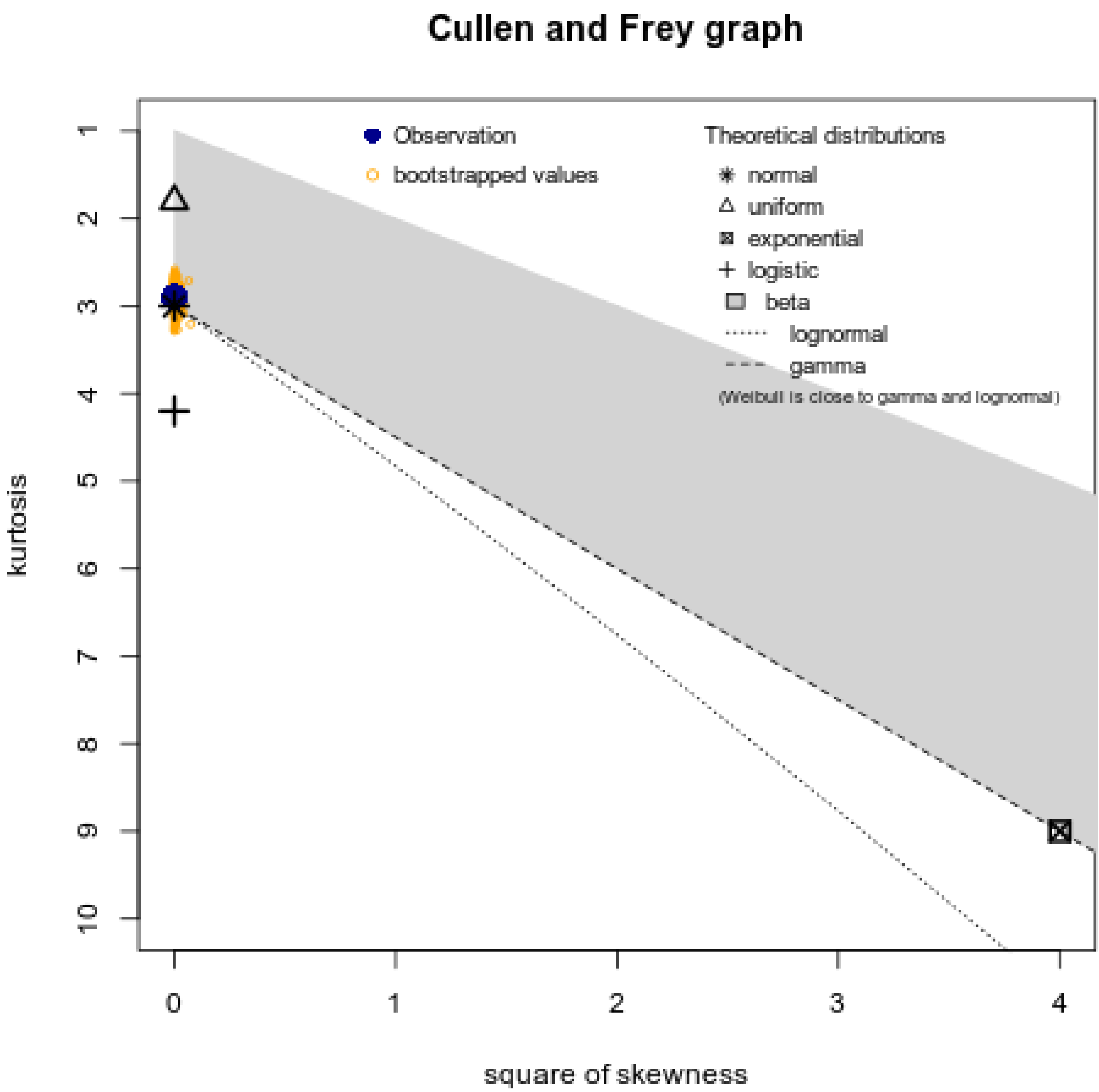


3.5 Plotando dados no espaço de Cullen-Frey

In [27]:
```
command = 'Rscript'
path_script = 'cullen_frey_script.R'

# define arguments
args = [name,]

# build subprocess command
cmd = [command, path_script] + args

x = subprocess.check_output(cmd, universal_newlines=True)
print(x)


Image(name+".png")
```

```
summary statistics
------
min:  -0.002573   max:  0.002692
median:  6.65e-05
mean:  5.816406e-05
estimated sd:  0.0008541091
estimated skewness:  -0.005145306
estimated kurtosis:  2.895282
```

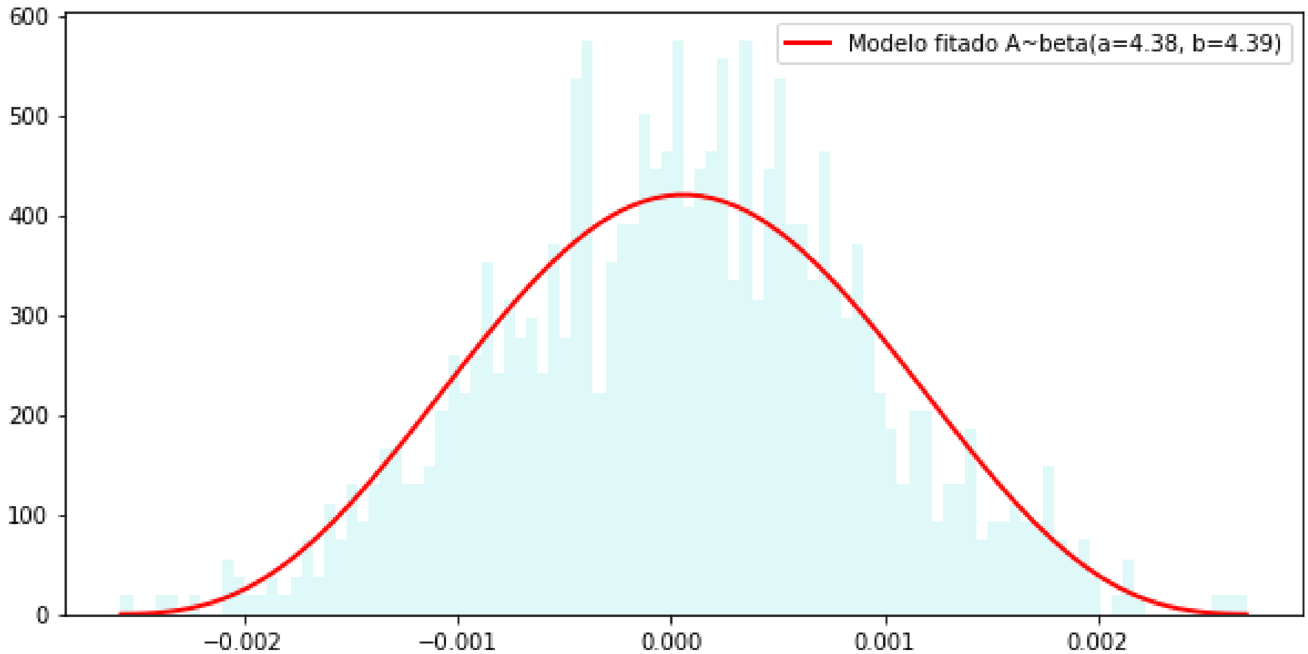
Out[27]:



3.6 Fitando melhor distribuição segundo método de Cullen-Frey

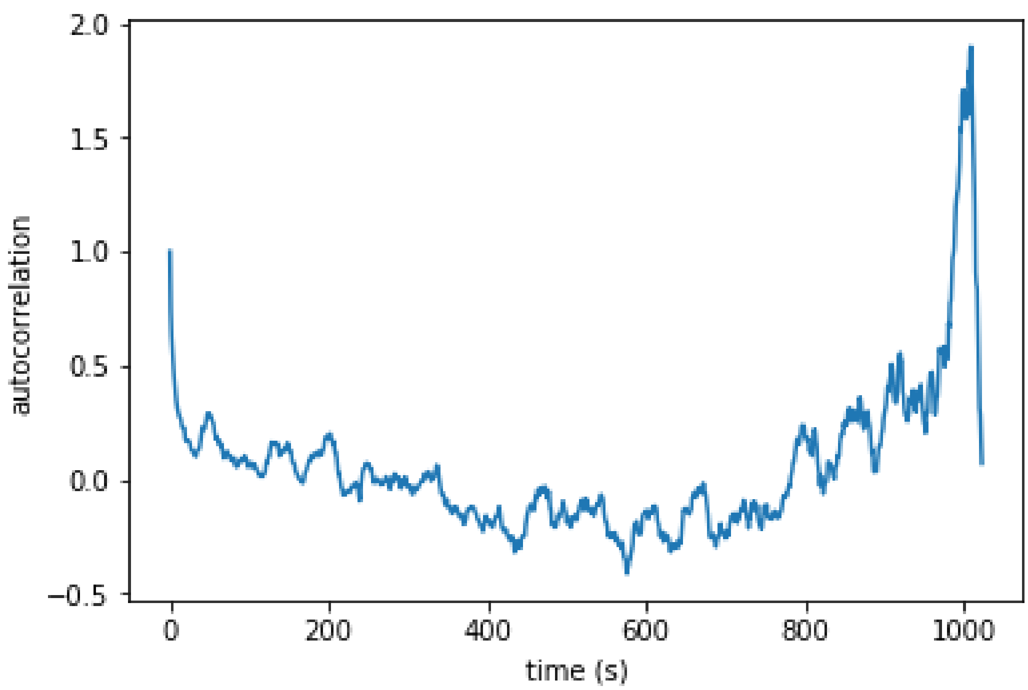
```
In [28]: aux.fitting_beta_distribution(A)
```

```
parametros de fitting:  (4.3843818669130332, 4.3877587909422644, -0.002673, 0.0054650000000000002)
        Fitado                         Original
mean :  5.844809656276864e-05          5.81640625e-05
var  :  7.640654596490277e-07          7.28789928162e-07
skew :  0.00044685700073701423          -0.005137765424454573
kurt :  -0.5096776319526652          -0.11006101397202306
```



3.7 Calculando autocorrelação

```
In [29]: aux.plot_estimated_autocorrelation(t, A, 0, len(A))
```



3.8 Plotando DFA e PSD

```
In [30]: aux.plot_psd_dfa(A, 'Ruído Rosa, últimos 1024 pontos')
```

```
Original time series data (1024 points):

First 10 points: [ 0.000383  0.000463  0.000772  0.001346  0.001949  0.002692  0.002
  0.001873  0.002616  0.001794]


1. Plotting time series data...
2. Plotting Power Spectrum Density...
3. Plotting Detrended Fluctuation Analysis...
```