Ruído Branco

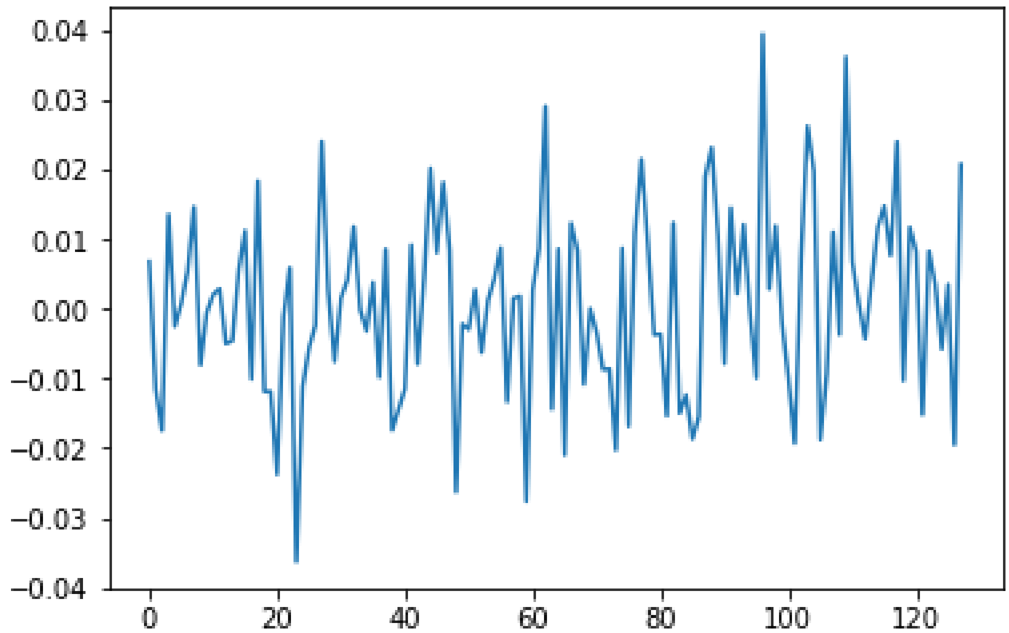
27 de maio de 2018

```
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.a"

        A = loadtxt("noise_equals_0.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()
```



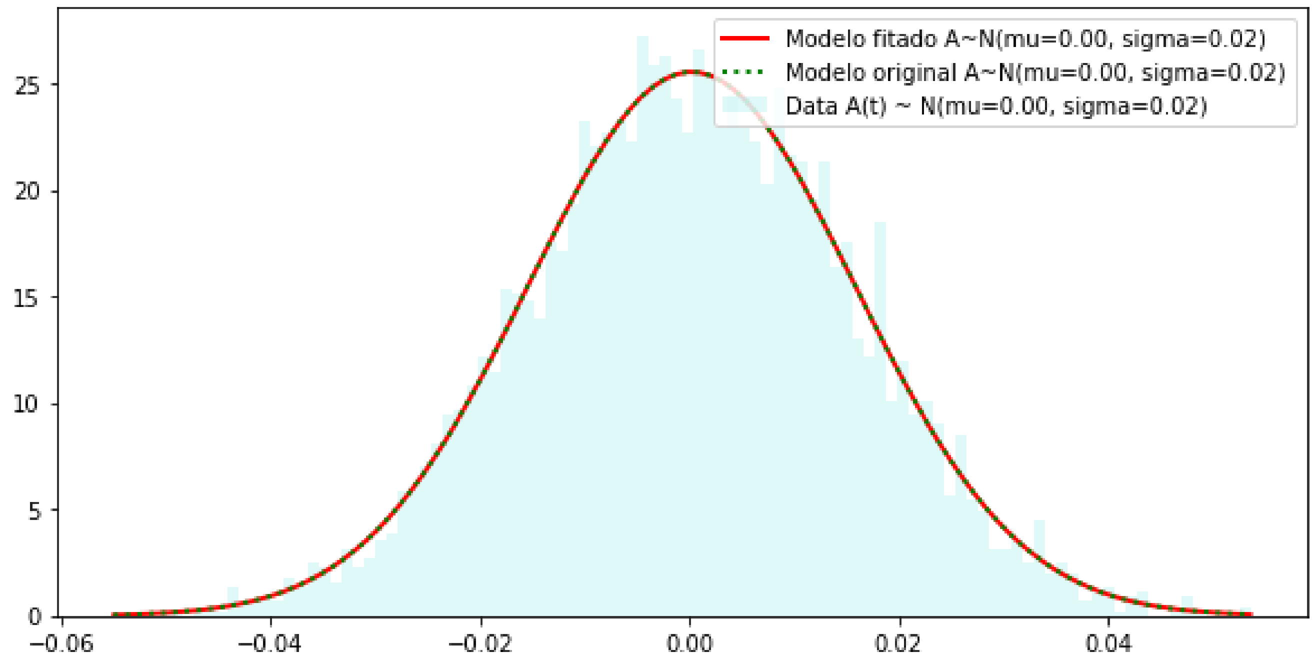
1.2 Calculando os momentos do ensemble

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 :  0.000244139892578
var  :  0.000244080973381
skew :  -0.0124526133947
kurt :  -0.0316808083098
Q1   :  -0.0102475
Q3   :  0.01094075
```

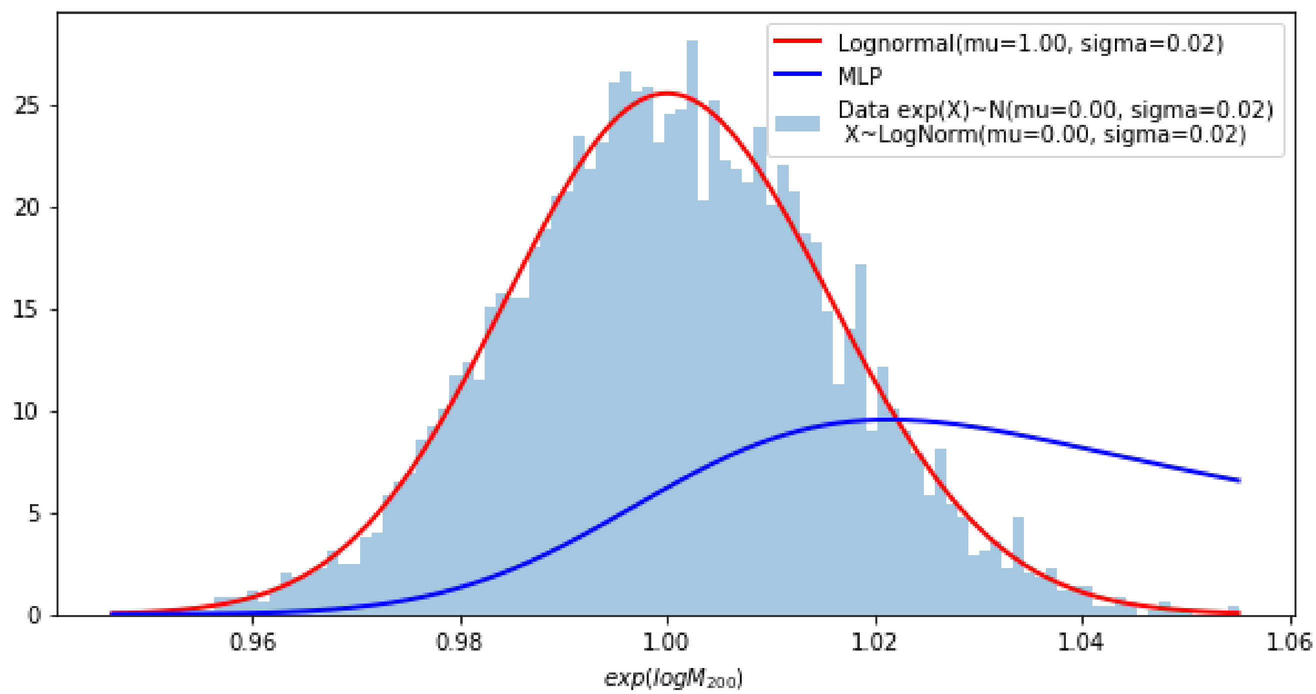
1.3 Fitando uma distribuição normal

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



1.4 Fitando uma distribuição lognormal

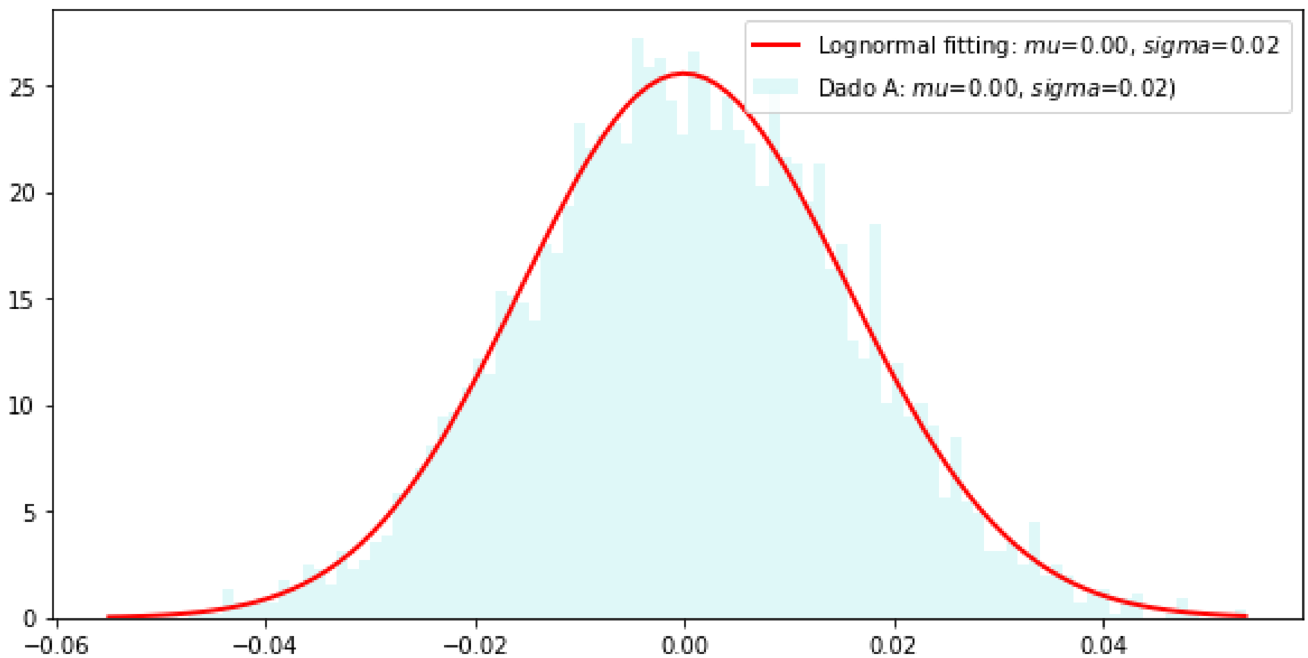
In [6]: `aux.fitting_lognormal_and_mlp_distribution(A)`



1.5 Fitando uma distribuição lognormal (utlizando minha implementação)

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

```
parametros de fitting:  (0.011417994500670603, -1.3672862986936898, 1.3674380894730875)
        Fitado                         Original
mean :  0.00024093054567897454          0.000244139892578
var  :  0.00024382595496086 16         0.000244080973381
skew :  0.034256588676742084          -0.012452613394741378
kurt :  0.0020863205464616286          -0.03168080830982545
```

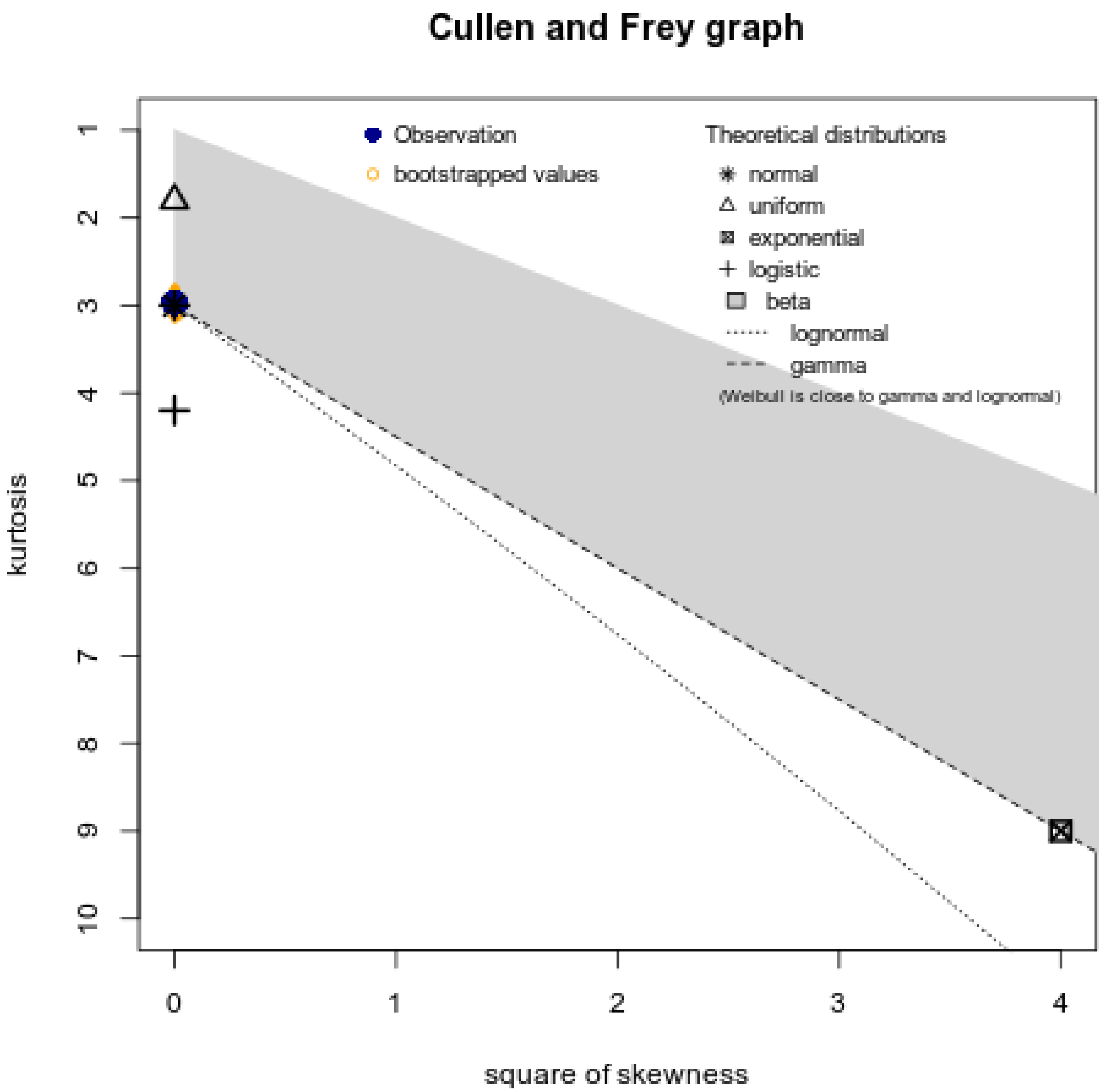


1.6 Plotando dados no espaço de Cullen-Frey

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:  -0.054942   max:  0.053577
median:  0.0001615
mean:  0.0002441399
estimated sd:  0.015625
estimated skewness:  -0.01245718
estimated kurtosis:  2.969747
```

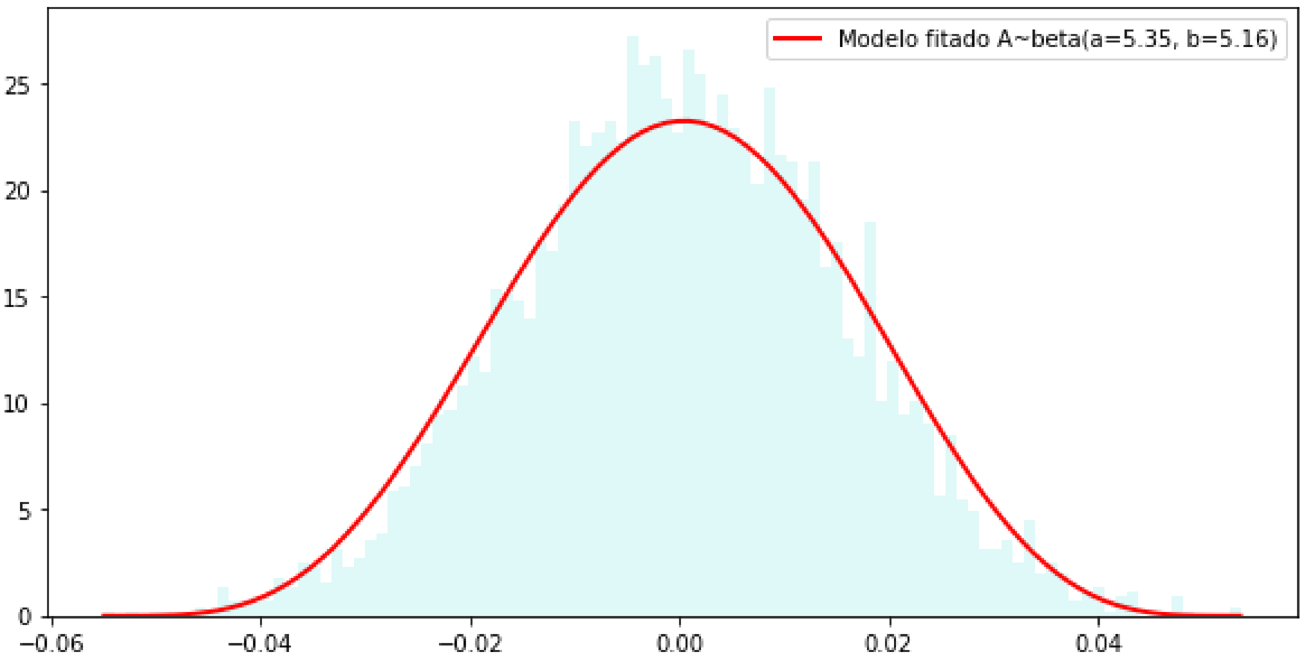
Out[8]:



1.7 Fitando melhor distribuição segundo método de Cullen-Frey

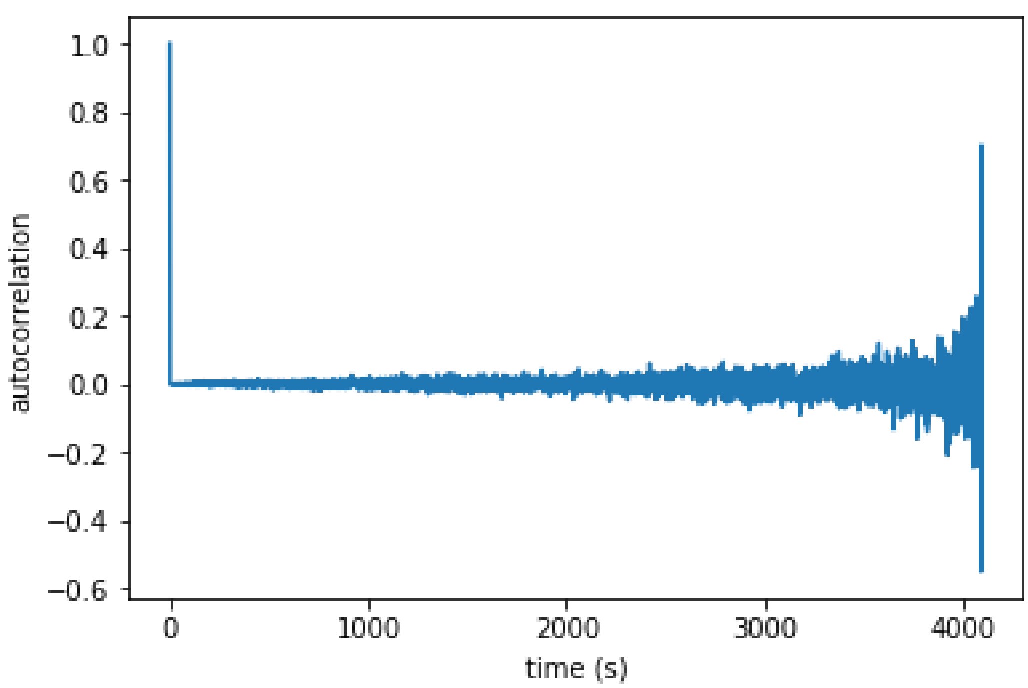
```
In [9]: aux.fitting_beta_distribution(A)
```

```
parametros de fitting:  (5.3454270868054445, 5.1648704245546053, -0.055042000000000001, 0.10871900000000
        Fitado                         Original
mean :  0.000251343201966063          0.000244139892578
var  :  0.0002566469871181539          0.000244080973381
skew :  -0.01863795375908599          -0.012452613394741378
kurt :  -0.4436231977558777          -0.03168080830982545
```



1.8 Calculando autocorrelação

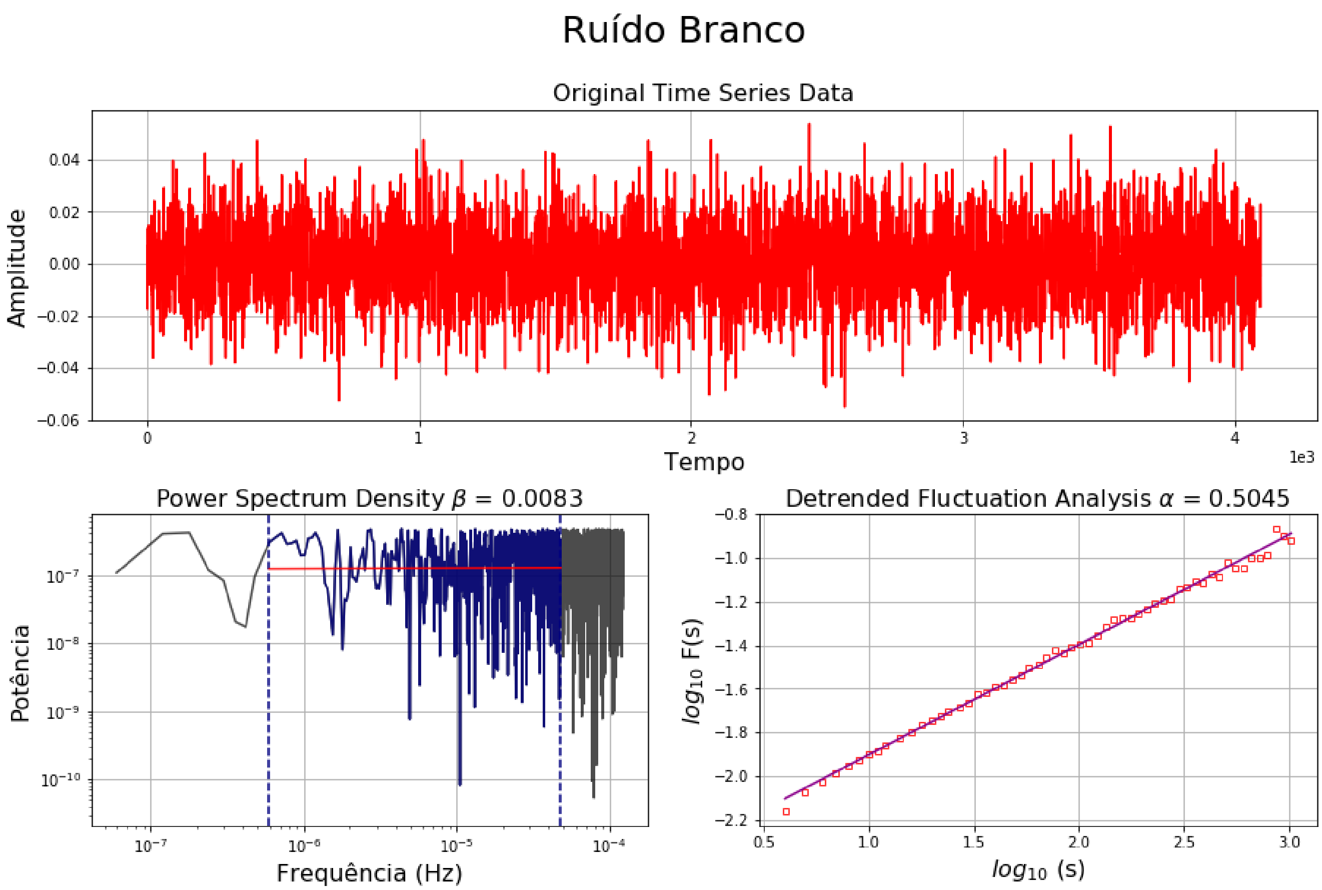
```
In [10]: aux.plot_estimated_autocorrelation(t, A, 0, len(A))
```



1.9 Plotando DFA e PSD

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

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

First 10 points: [ 0.006781 -0.011505 -0.017438  0.013577 -0.002498  0.000782  0.005427
  0.014654 -0.008031 -0.000515]


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.a"
         savetxt(name + ".txt", A)
```

2.1 Calculando os momentos do ensemble

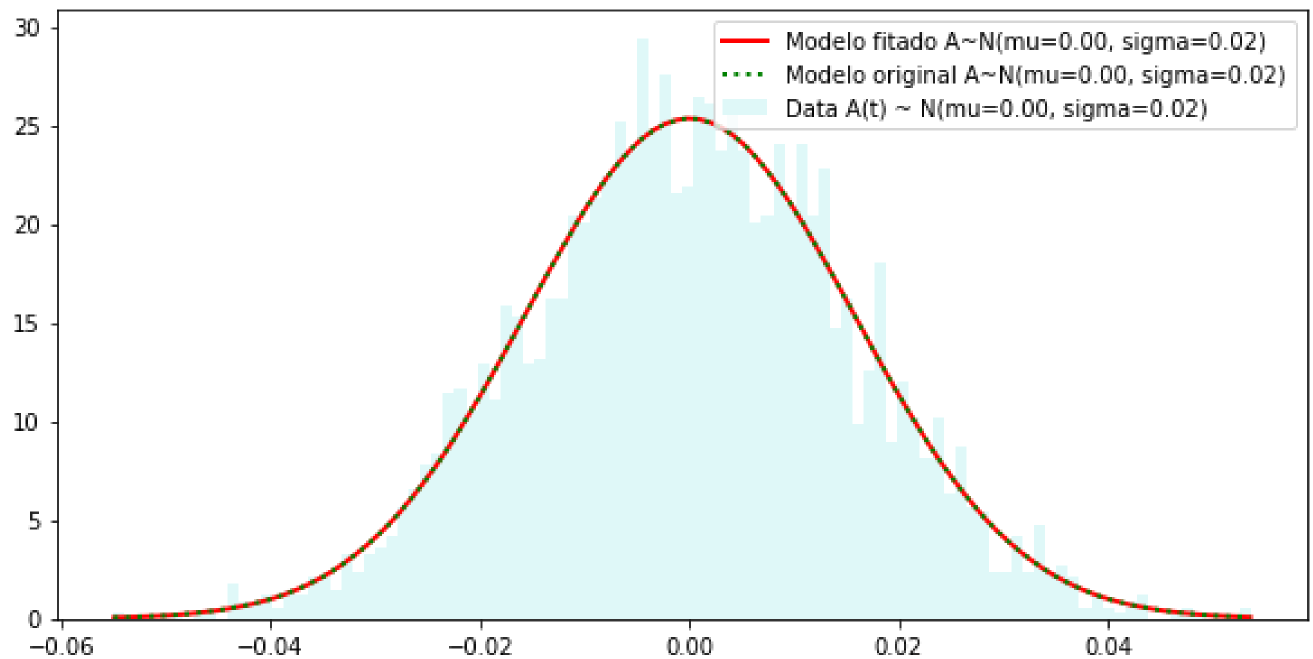
```
In [13]: A_mean, A_var, A_skew, A_kurtosis = aux.calcMoments(A)

         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 :  5.90999348958e-05
var  :  0.000247685013951
skew :  -0.0149334937808
kurt :  -0.0382125473736
Q1   :  -0.01037125
Q3   :  0.01078425
```

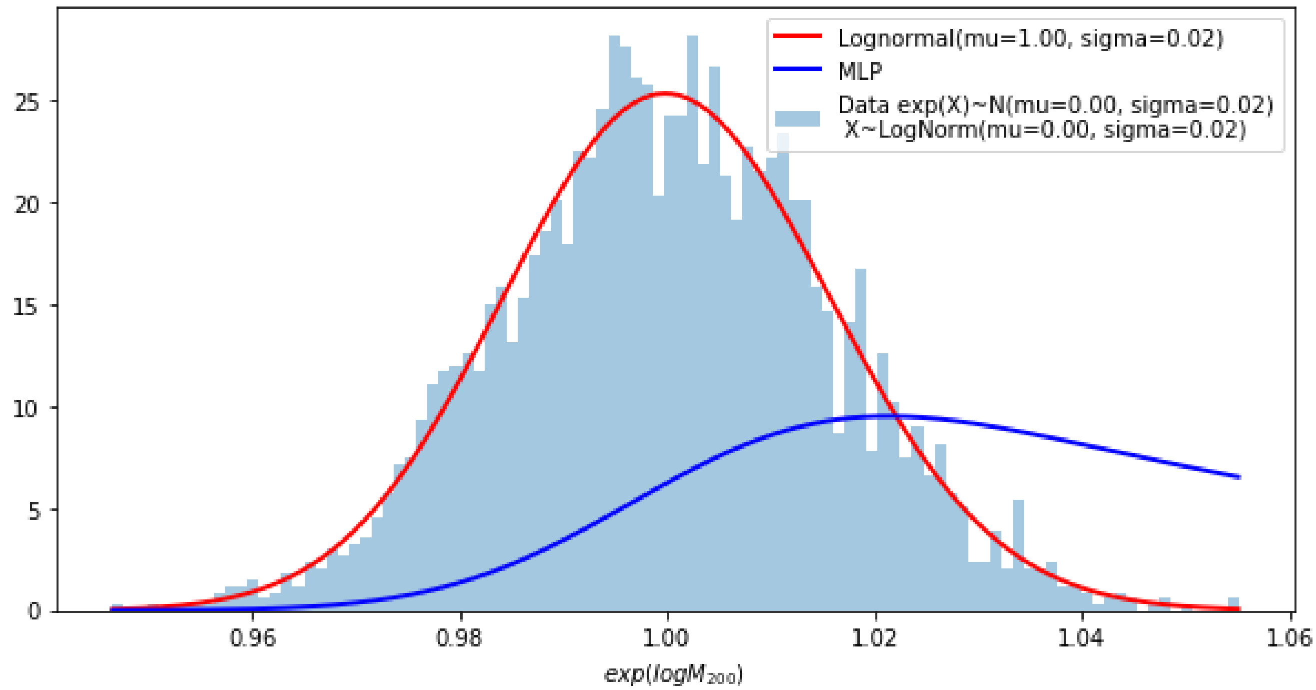
2.2 Fitando uma distribuição normal

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



2.3 Fitando uma distribuição lognormal

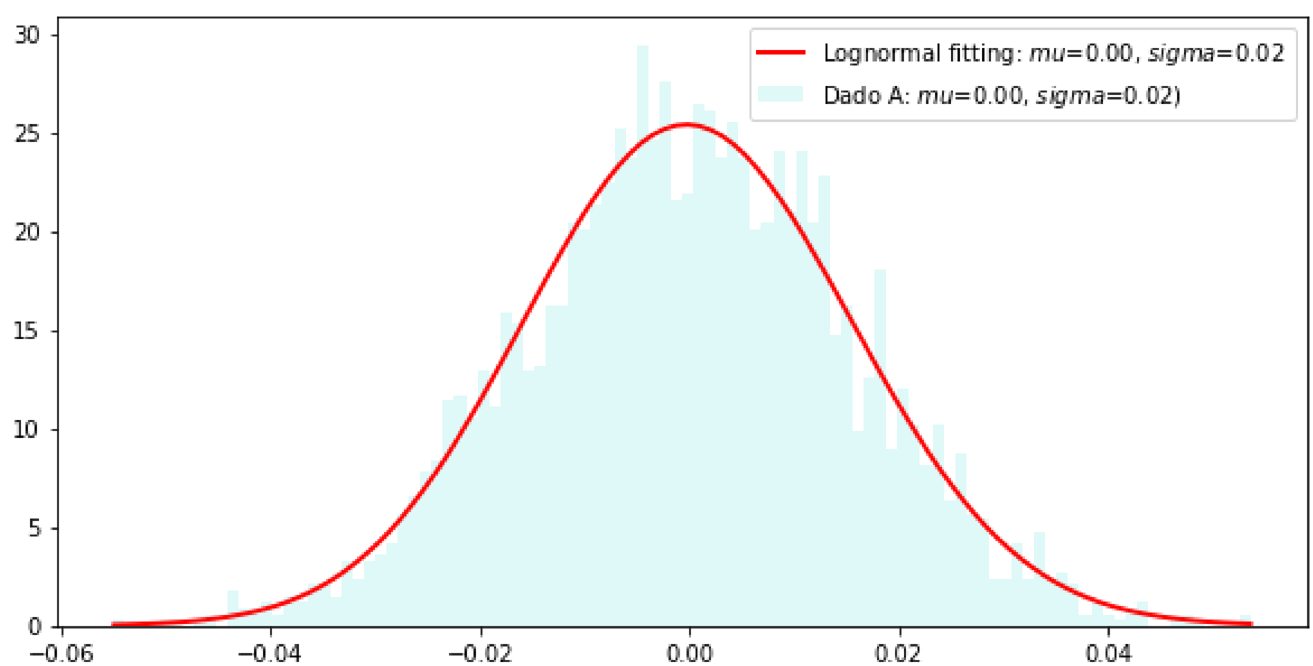
In [15]:
```
aux.fitting_lognormal_and_mlp_distribution(A)
```



2.4 Fitando uma distribuição lognormal (utlizando minha implementação)

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

```
parametros de fitting:  (0.012803478193939413, -1.2270200015184742, 1.2269823990610935)
        Fitado                         Original
mean :  6.297069617078321e-05          5.90999348958e-05
var  :  0.0002468535565636142          0.000247685013951
skew :  0.03841410790226739          -0.01493349378084308
kurt :  0.0026234830389721964          -0.03821254737355151
```

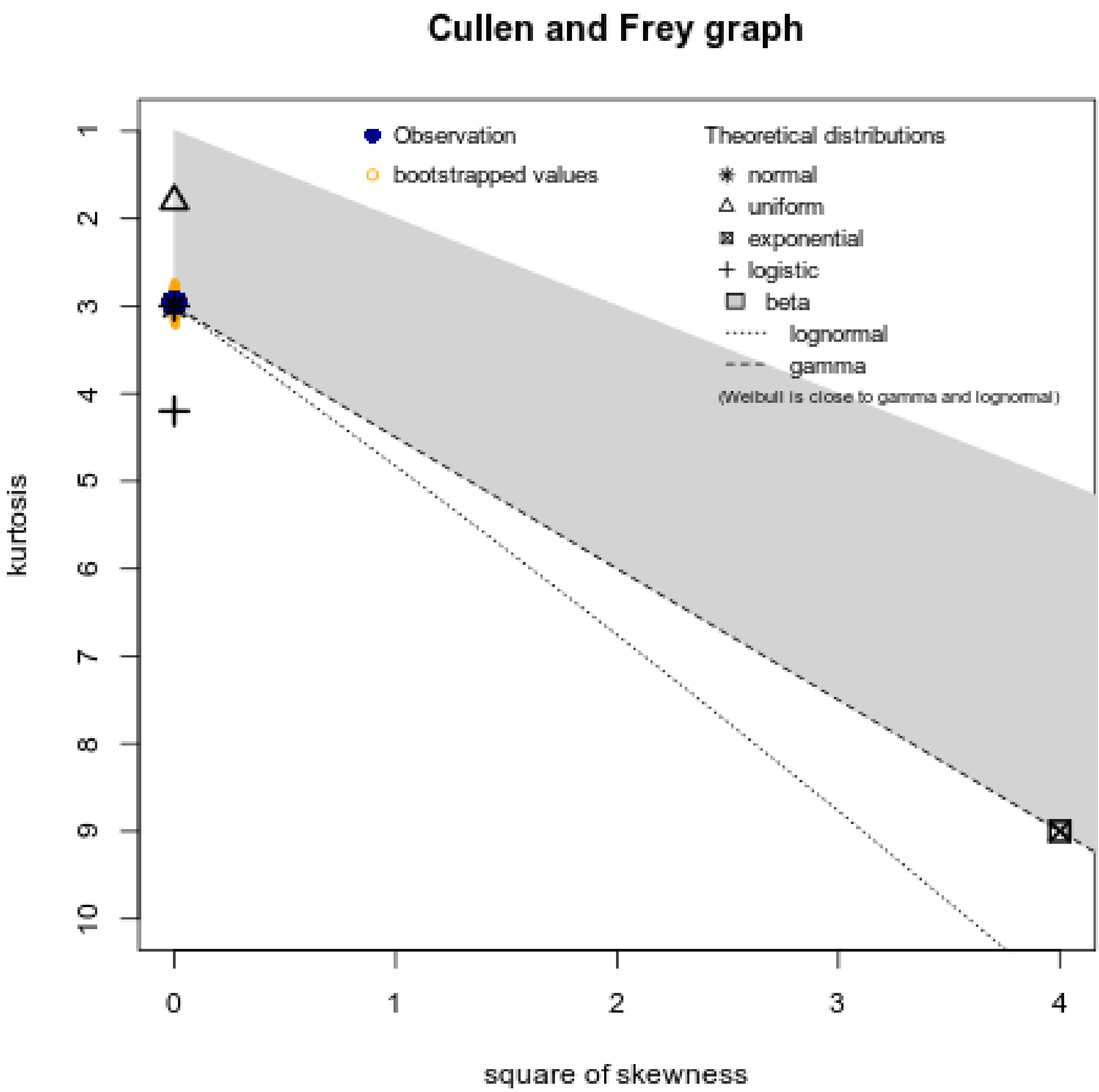


2.5 Plotando dados no espaço de Cullen-Frey

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:  -0.054942   max:  0.053577
median:  3.95e-05
mean:  5.909993e-05
estimated sd:  0.01574057
estimated skewness:  -0.01494079
estimated kurtosis:  2.963681
```

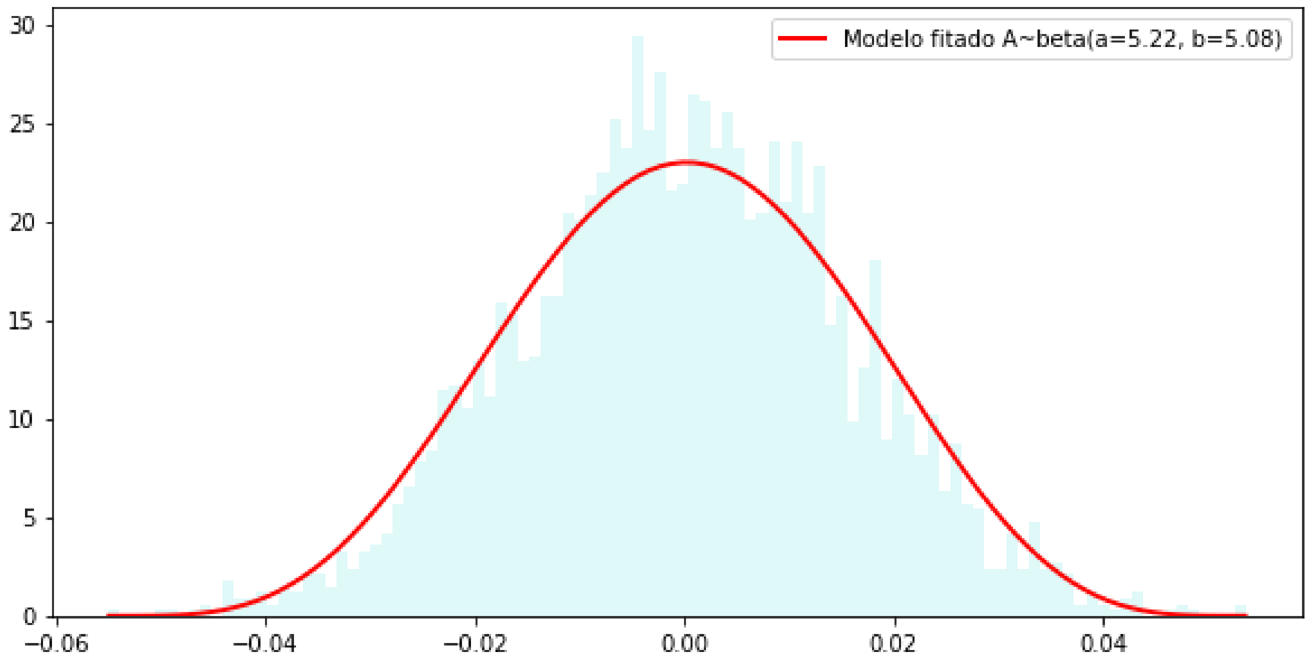
Out[17]:



2.6 Fitando melhor distribuição segundo método de Cullen-Frey

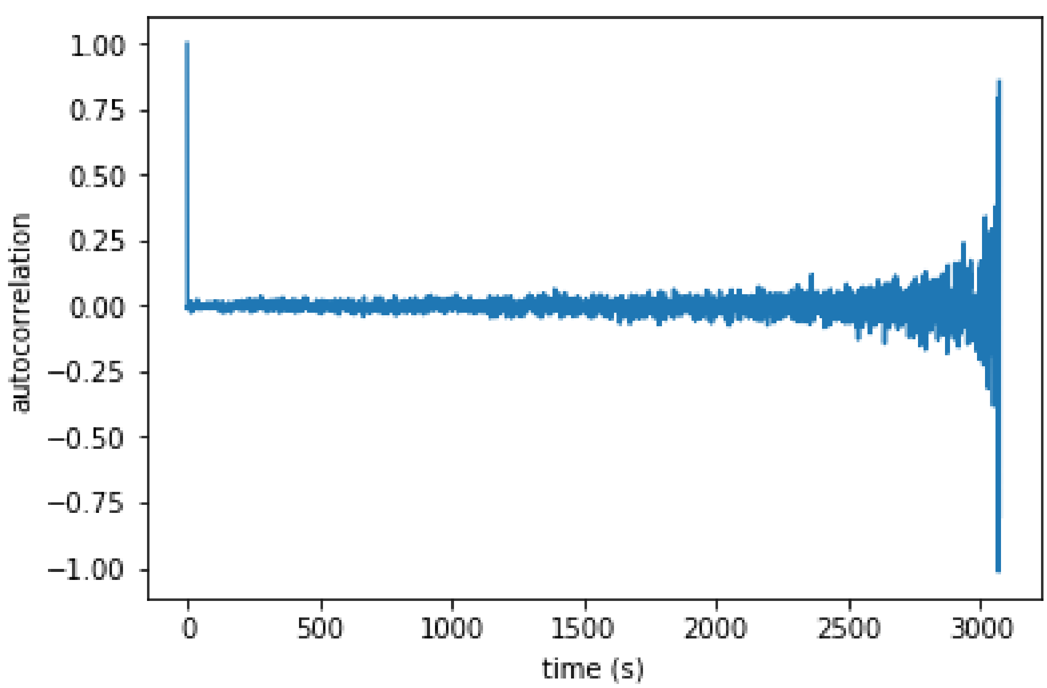
```
In [18]: aux.fitting_beta_distribution(A)
```

```
parametros de fitting:  (5.2175018784201894, 5.0753769576729191, -0.055042000000000001, 0.10871900000000
        Fitado                         Original
mean :  6.810046391197283e-05          5.90999348958e-05
var  :  0.000261615473084778          0.000247685013951
skew :  -0.015100228025246264          -0.01493349378084308
kurt :  -0.4510531990846237          -0.03821254737355151
```



2.7 Calculando autocorrelação

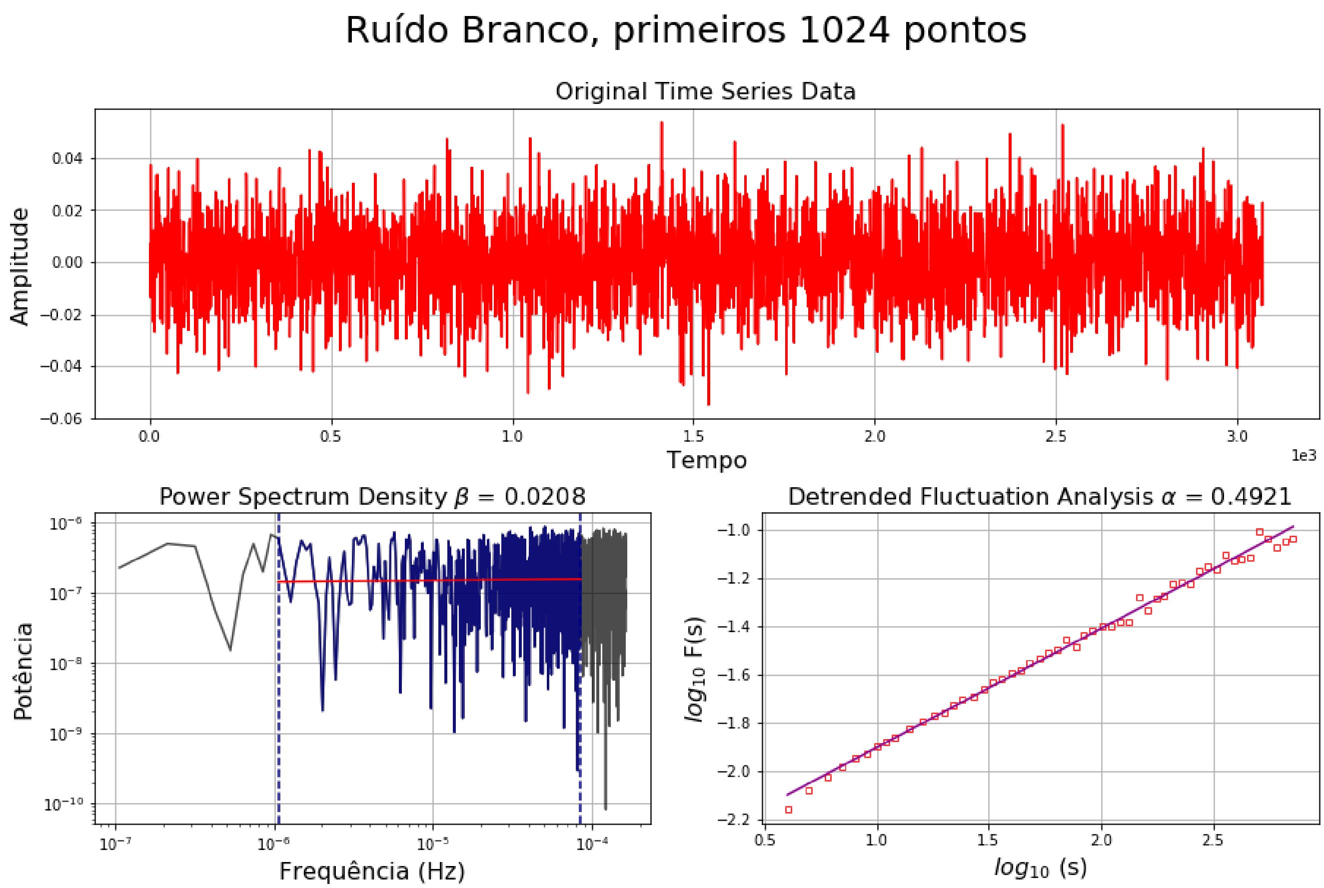
```
In [19]: aux.plot_estimated_autocorrelation(t, A, 0, len(A))
```



2.8 Plotando DFA e PSD

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

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

First 10 points: [-0.012768  0.006756 -0.013789  0.037198  0.010417 -0.008015 -0.00905
 -0.003471  0.011726 -0.0231   ]


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.a"
savetxt(name + ".txt", A)
```

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

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

3.1 Calculando os momentos do ensemble

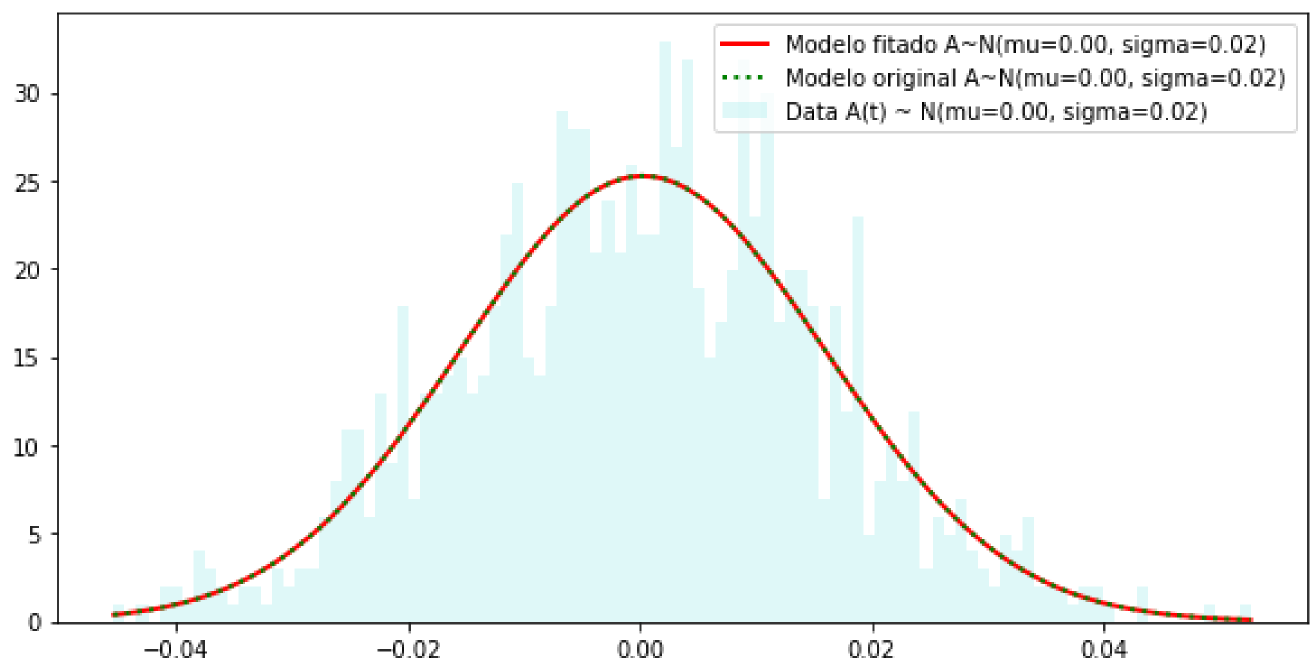
In [23]:
```
A_mean, A_var, A_skew, A_kurtosis = aux.calcMoments(A)

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 :  0.000239537109375
var  :  0.00024904711636
skew :  0.00244735055281
kurt :  -0.0612961001147
Q1   :  -0.01045425
Q3   :  0.010872
```

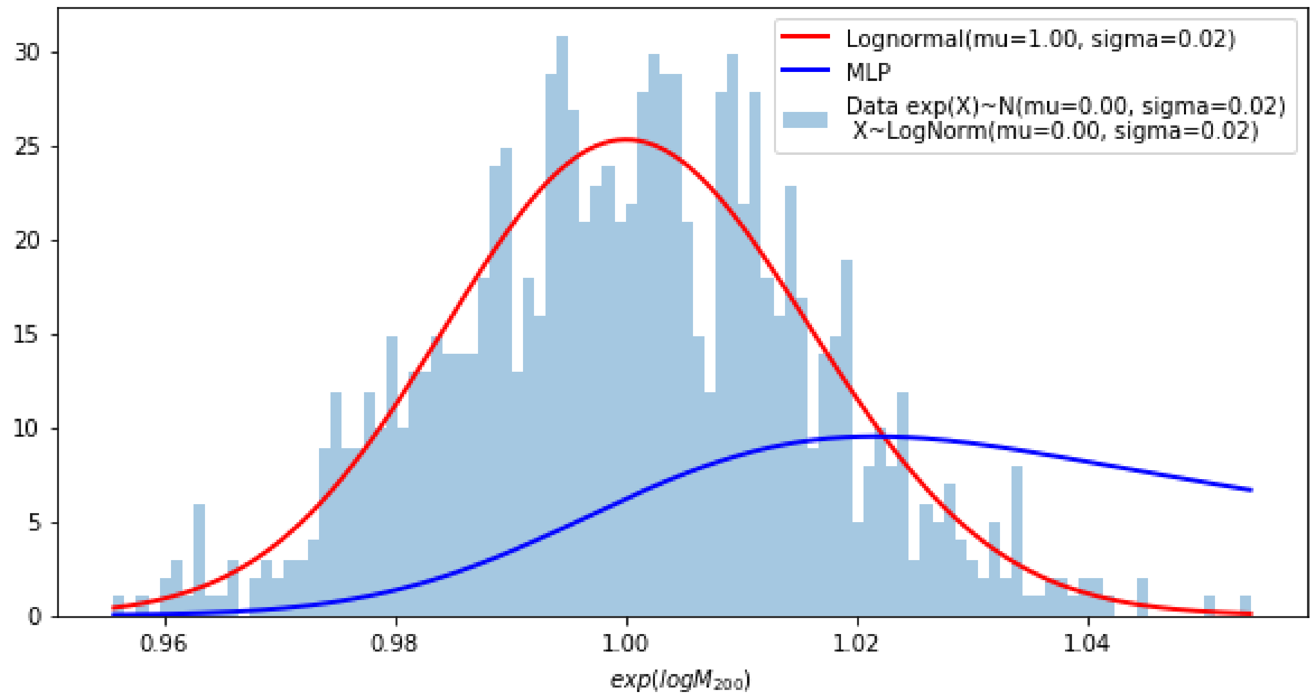
3.2 Fitando uma distribuição normal

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



3.3 Fitando uma distribuição lognormal

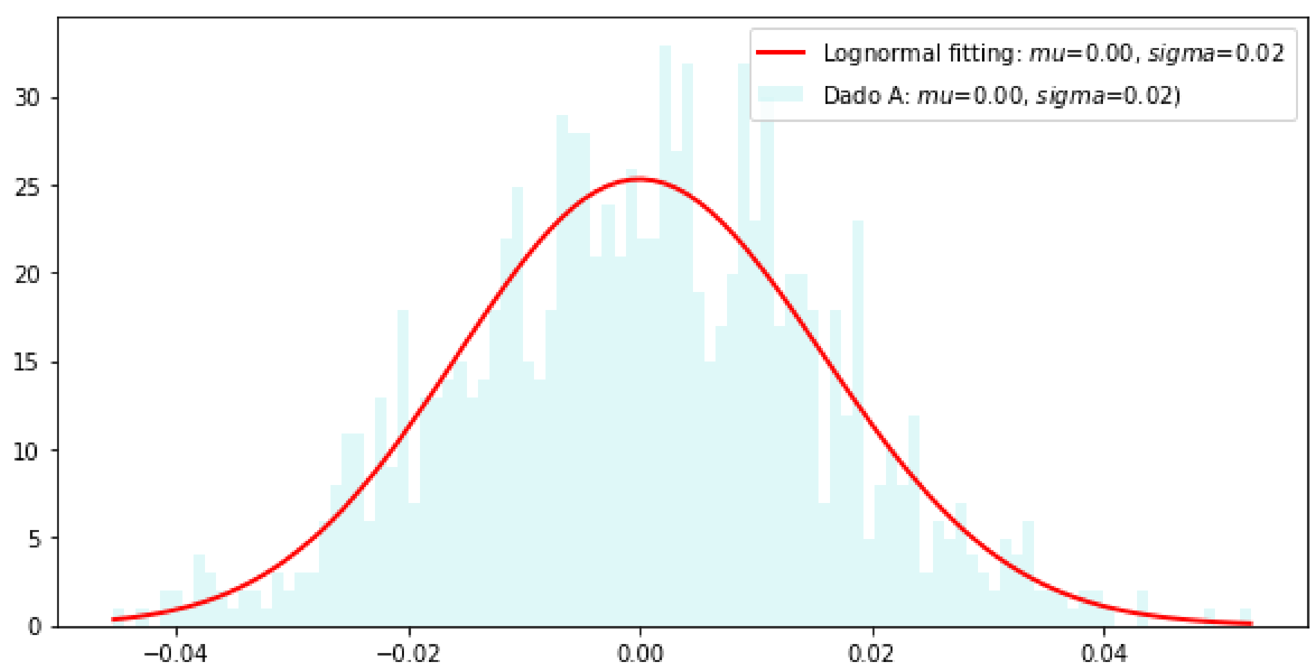
```
In [25]: aux.fitting_lognormal_and_mlp_distribution(A)
```



3.4 Fitando uma distribuição lognormal (utlizando minha implementação)

```
In [26]: aux.fitting_lognormal_distribution(A)
```

```
parametros de fitting:  (0.012872907609001054, -1.2237396466174393, 1.2238831089400644)
        Fitado                         Original
mean :  0.00024487242985715696          0.000239537109375
var  :  0.000248279658092205          0.00024904711636
skew :  0.03862245623346354          0.0024473505528065276
kurt :  0.0026520197015029723           -0.0612961001147494
```

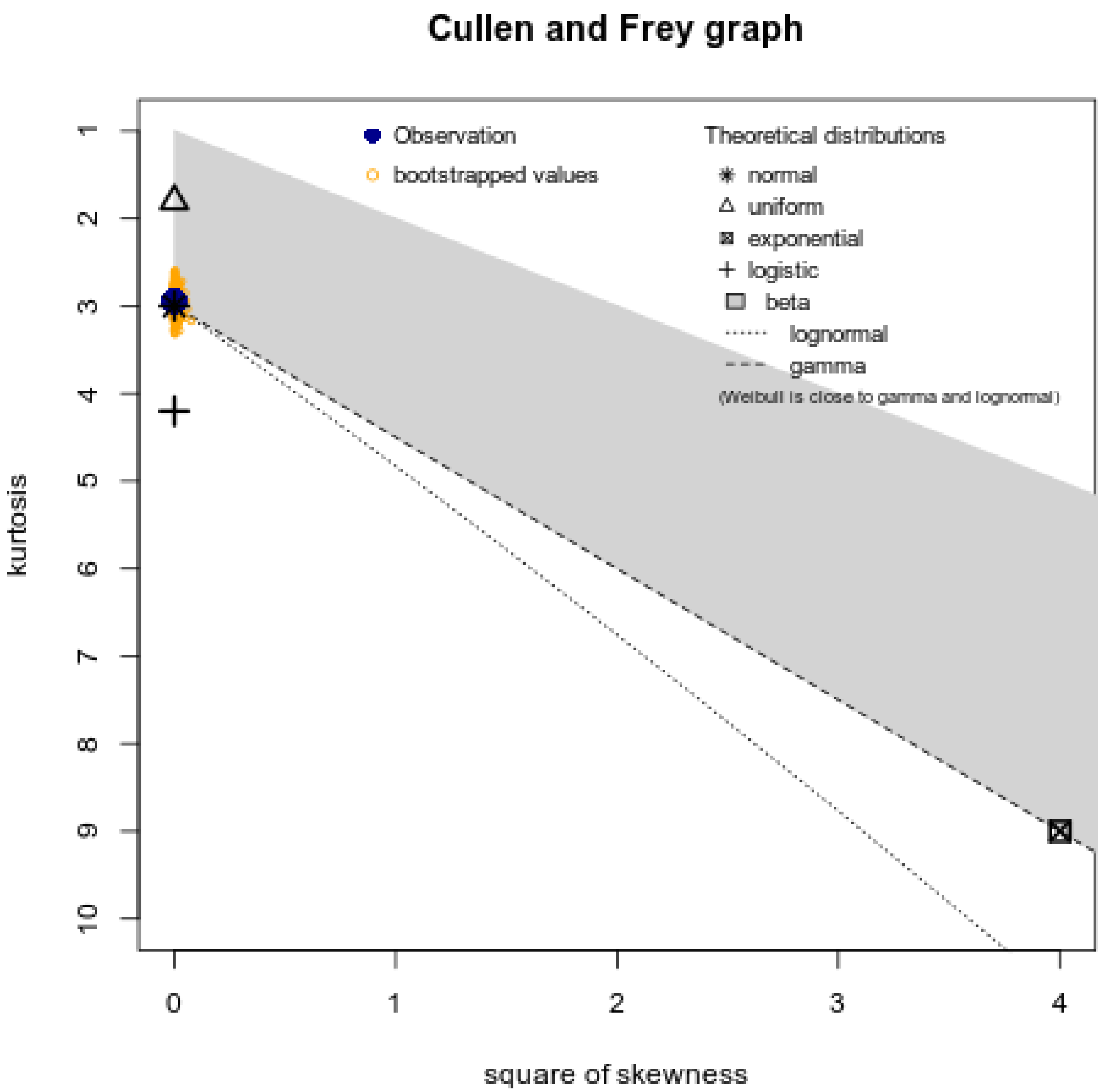


3.5 Plotando dados no espaço de Cullen-Frey

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:  -0.045366   max:  0.052593
median:  0.000513
mean:  0.0002395371
estimated sd:  0.01578894
estimated skewness:  0.002450942
estimated kurtosis:  2.944286
```

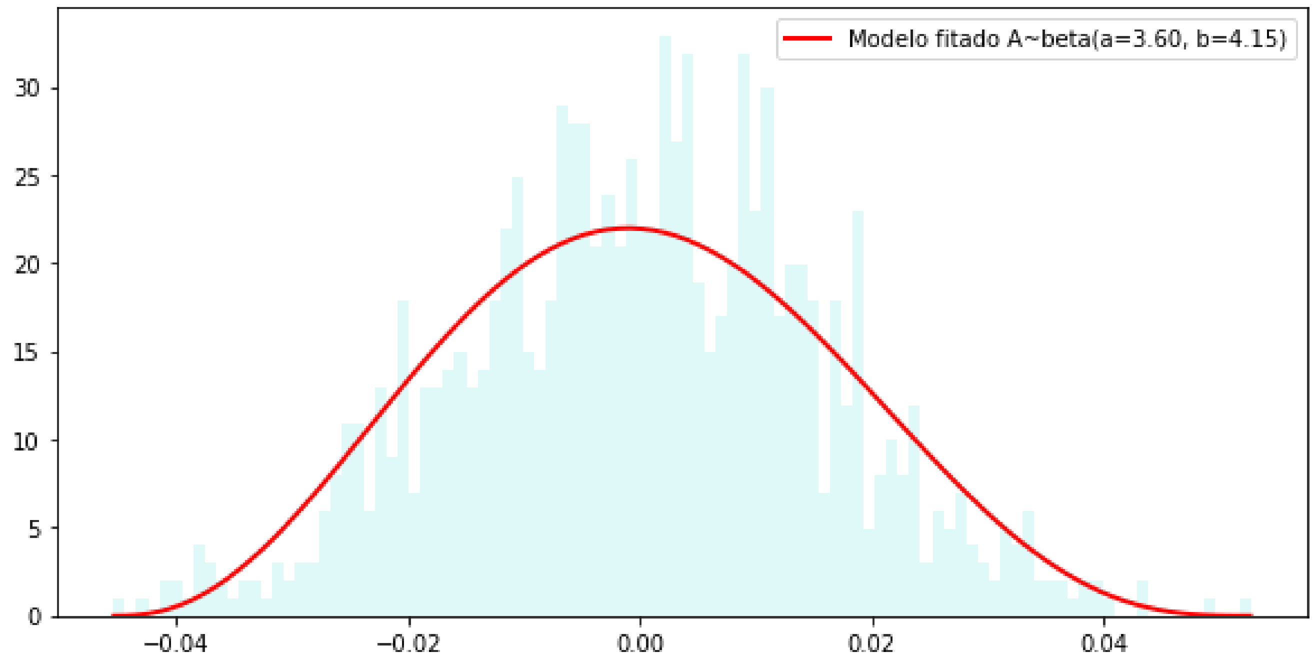
Out[27]:



3.6 Fitando melhor distribuição segundo método de Cullen-Frey

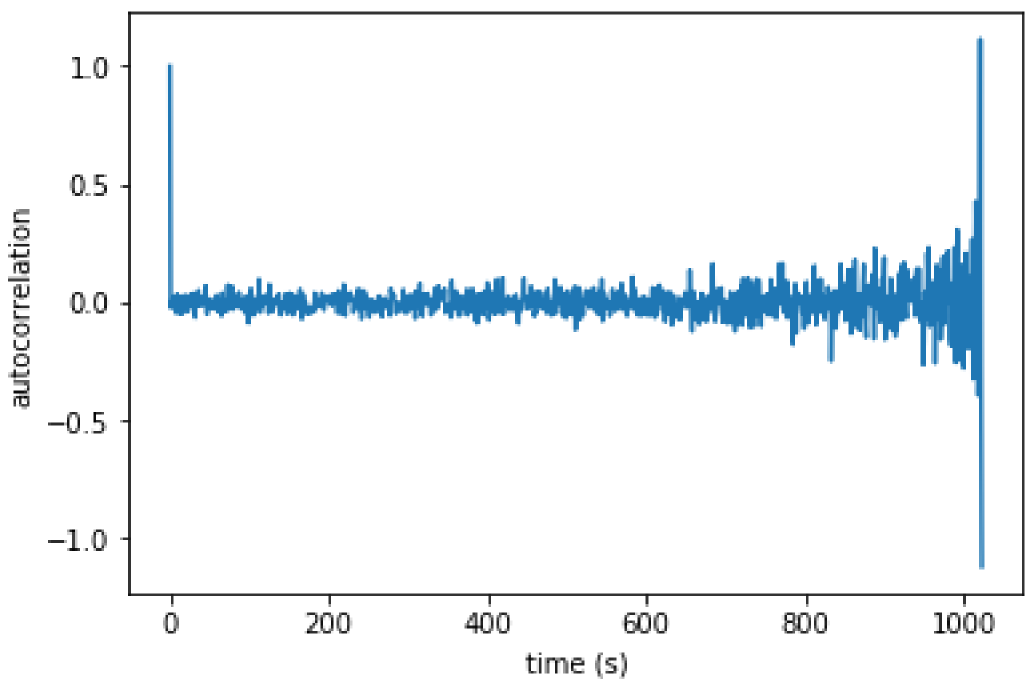
```
In [28]: aux.fitting_beta_distribution(A)
```

```
parametros de fitting:  (3.6018758436472313, 4.1450840082006177, -0.045465999999999999, 0.09815899999999
        Fitado                         Original
mean :  0.00017210032554076937           0.000239537109375
var  :  0.00027403282158935027           0.00024904711636
skew :  0.08531485091438108           0.0024473505528065276
kurt :  -0.5483953974435325           -0.0612961001147494
```



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 Branco, últimos 1024 pontos')
```

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

First 10 points: [ 0.01691   0.031484 -0.012856 -0.011338 -0.003417 -0.004586  0.004353
  0.021552 -0.004382 -0.017373]


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