Mapeamento de Henon com $a = 1.2$, $b = 0.2$ e $X_0 = Y_0 = 0.0001$

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
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)
```

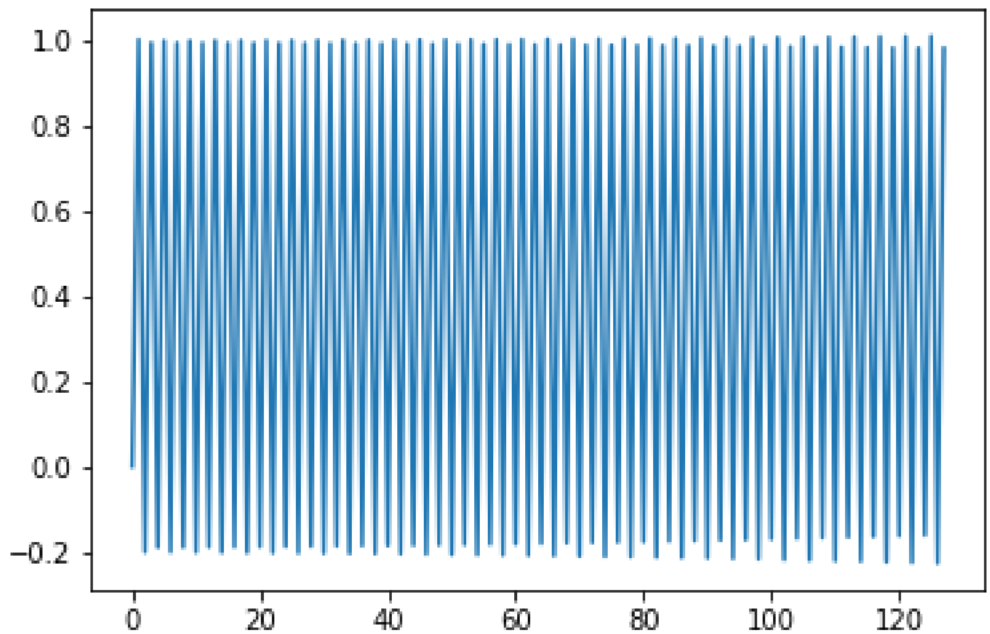
1 Série Completa

1.1 Gerando série temporal e plotando resultado

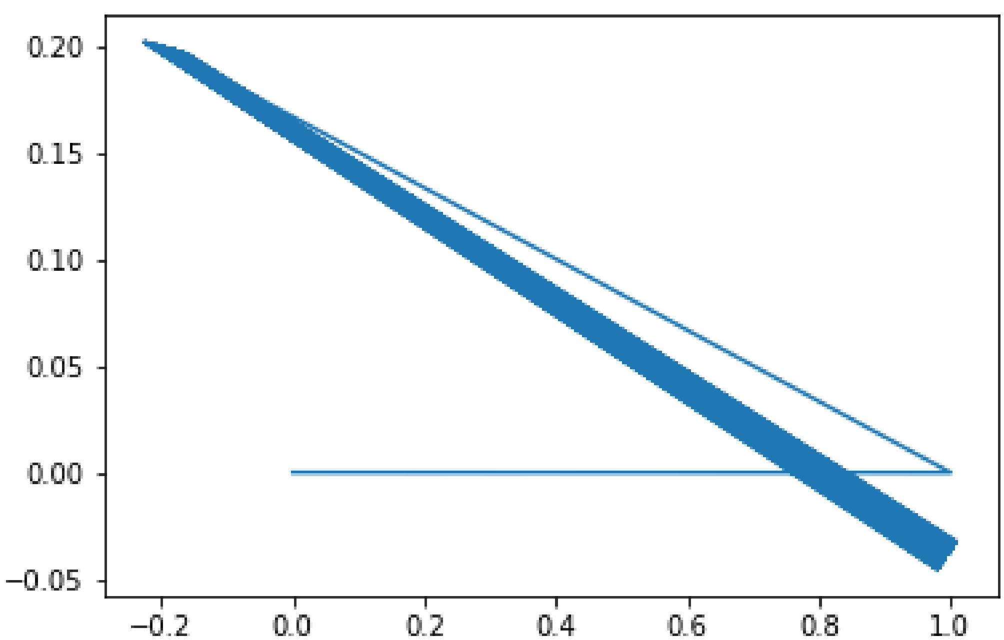
In [2]:
```
name = "A.ex:1.2.b"

a = 1.2
b = 0.2

# A desempenha o [apel de X]
A = zeros(size)
Y = zeros(size)

A[0] = 0.0001
Y[0] = 0.0001

for i in range(0, size-1):
    A[i+1] = 1 - a*A[i]**2.0 + b*Y[i]
    Y[i+1] = b*A[i]

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

```
    save_A = A
```

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



In [4]:
```
plt.plot(A[0:128], Y[0:128])
plt.show()
```



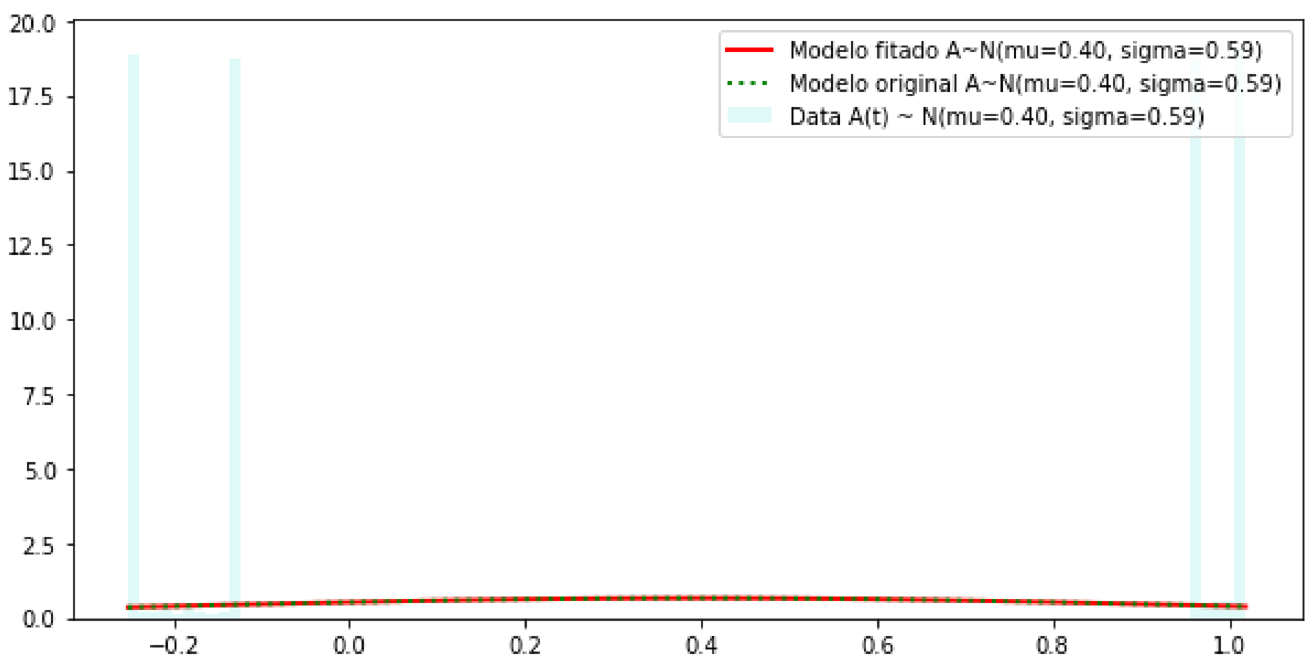
1.2 Calculando os momentos do ensemble

In [5]:
```
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 :  0.401326242368
var  :  0.351227540087
skew :  -0.0130448511953
kurt :  -1.97452655084
Q1   :  -0.191633648323
Q3   :  0.993207510857
```

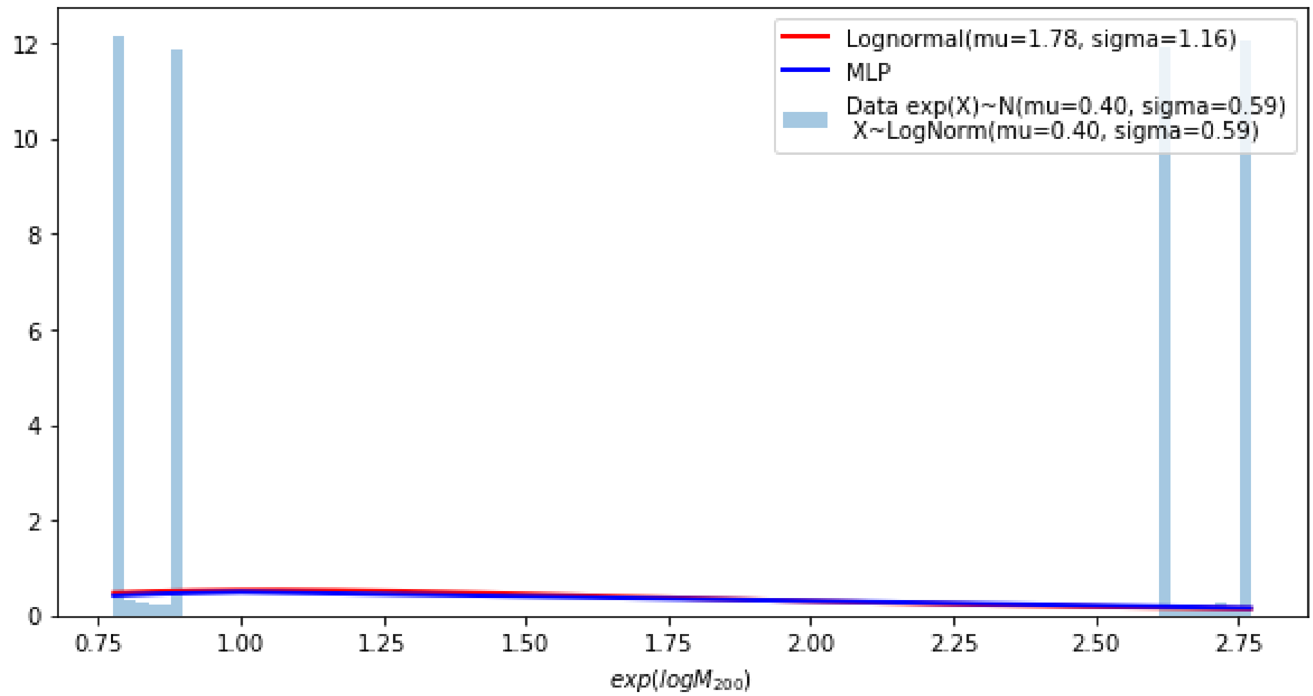
1.3 Fitando uma distribuição normal

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



1.4 Fitando uma distribuição lognormal

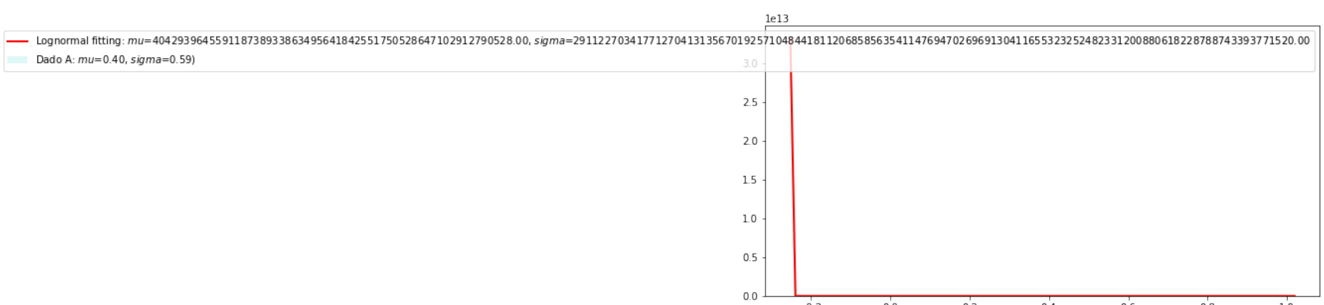
In [7]:
```
aux.fitting_lognormal_and_mlp_distribution(A)
```



1.5 Fitando uma distribuição lognormal (utlizando minha implementação)

```
In [8]: aux.fitting_lognormal_distribution(A)
```

```
parametros de fitting:  (16.181406174481673, -0.25188173620479981, 0.56145950782959431)
        Fitado                         Original
mean :  4.042939645591187e+56          0.401326242368
var  :  8.475242844523751e+226          0.351227540087
skew :  3.7336744886360834e+170          -0.013044851195298805
kurt :  inf          -1.9745265508416838


/usr/lib64/python3.4/site-packages/numpy/lib/polynomial.py:680: RuntimeWarning: overflow encountered in
  y = y * x + p[i]
```

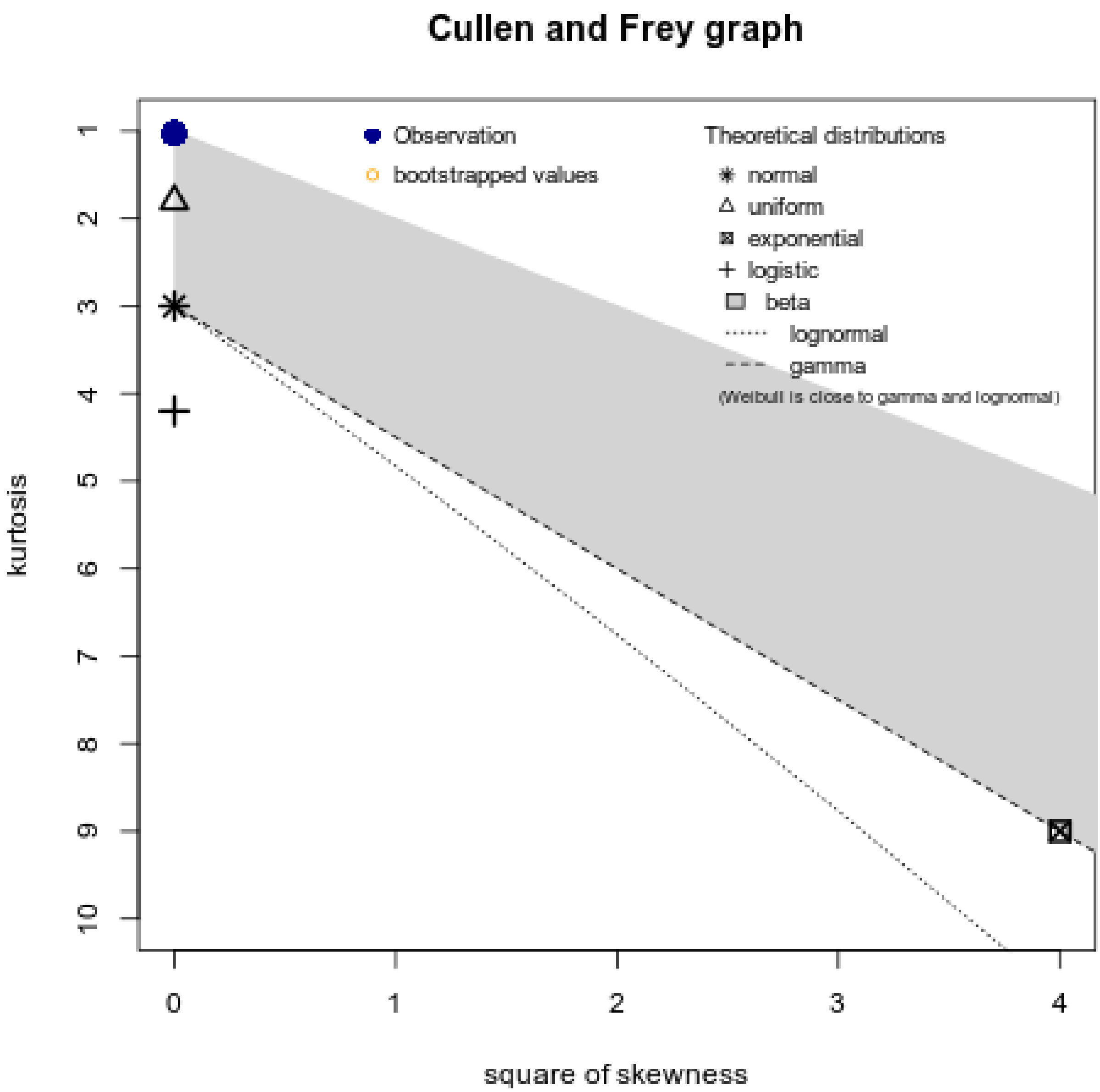


1.6 Plotando dados no espaço de Cullen-Frey

In [9]:
```
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:  -0.2518817   max:  1.019319
median:  0.4823697
mean:  0.4013262
estimated sd:  0.5927169
estimated skewness:  -0.01304963
estimated kurtosis:  1.024527
```

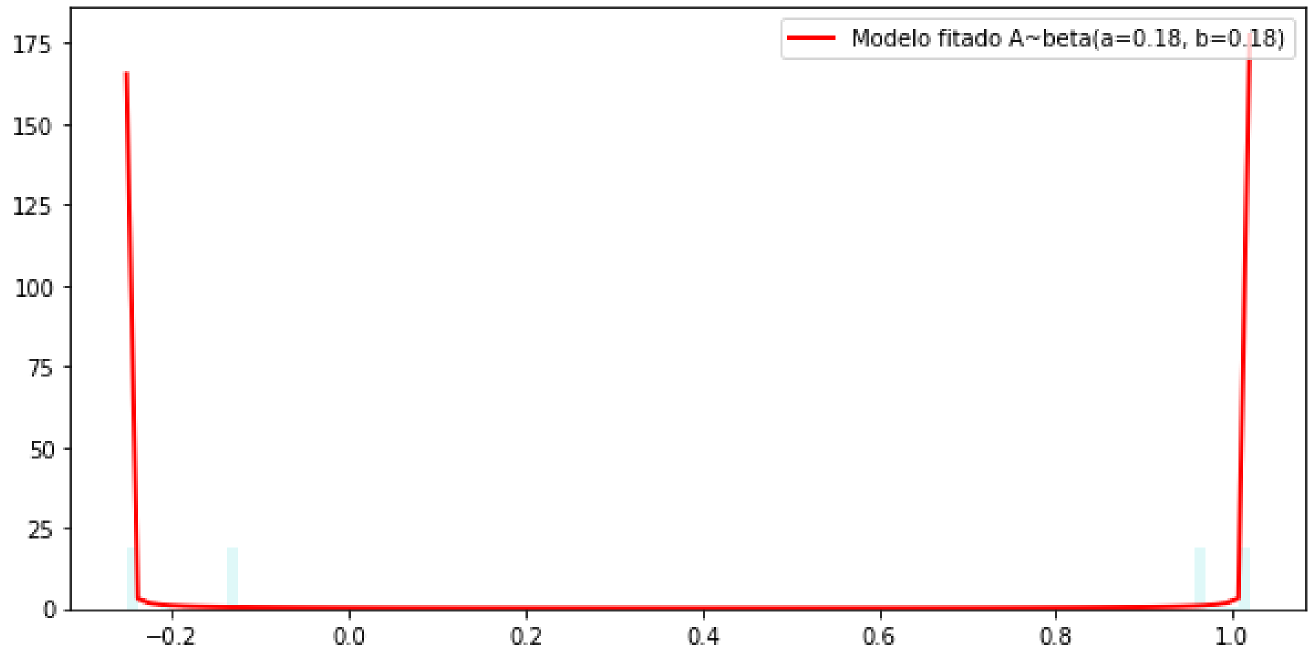
Out[9]:



1.7 Fitando melhor distribuição segundo método de Cullen-Frey

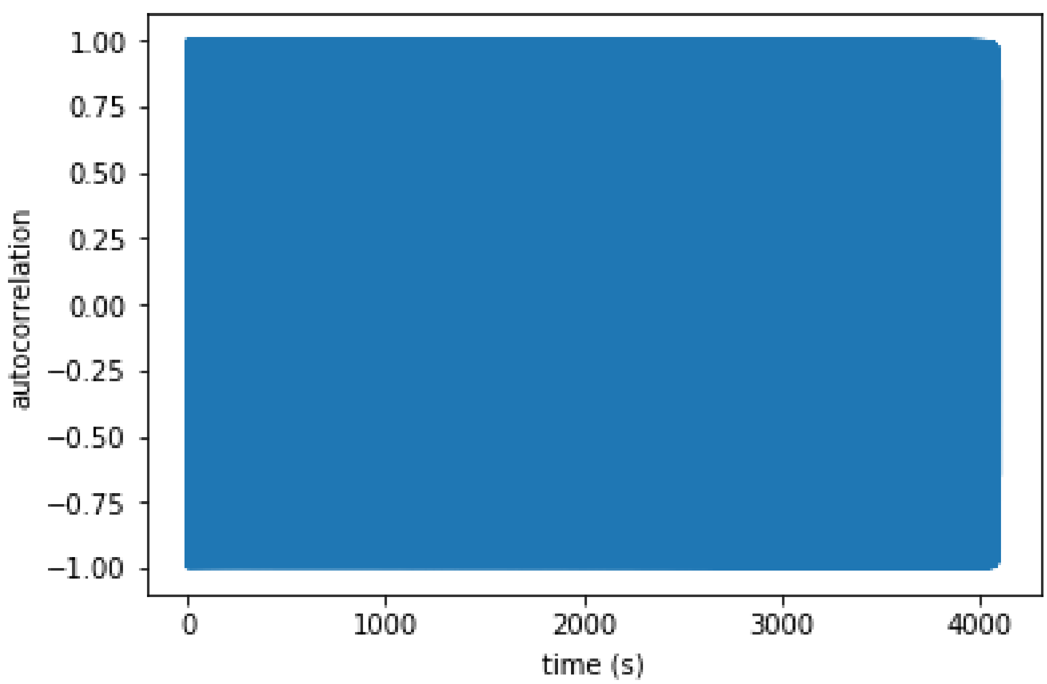
In [10]: aux.fitting_beta_distribution(A)

```
parametros de fitting:  (0.18375603185627709, 0.1763677443863115, -0.25198173620479974, 1.27140067508472
        Fitado                         Original
mean :  0.39676060841502175          0.401326242368
var  :  0.29699122407725503          0.351227540087
skew :  -0.040559989569617295          -0.013044851195298805
kurt :  -1.7839152348474876          -1.9745265508416838
```



1.8 Calculando autocorrelação

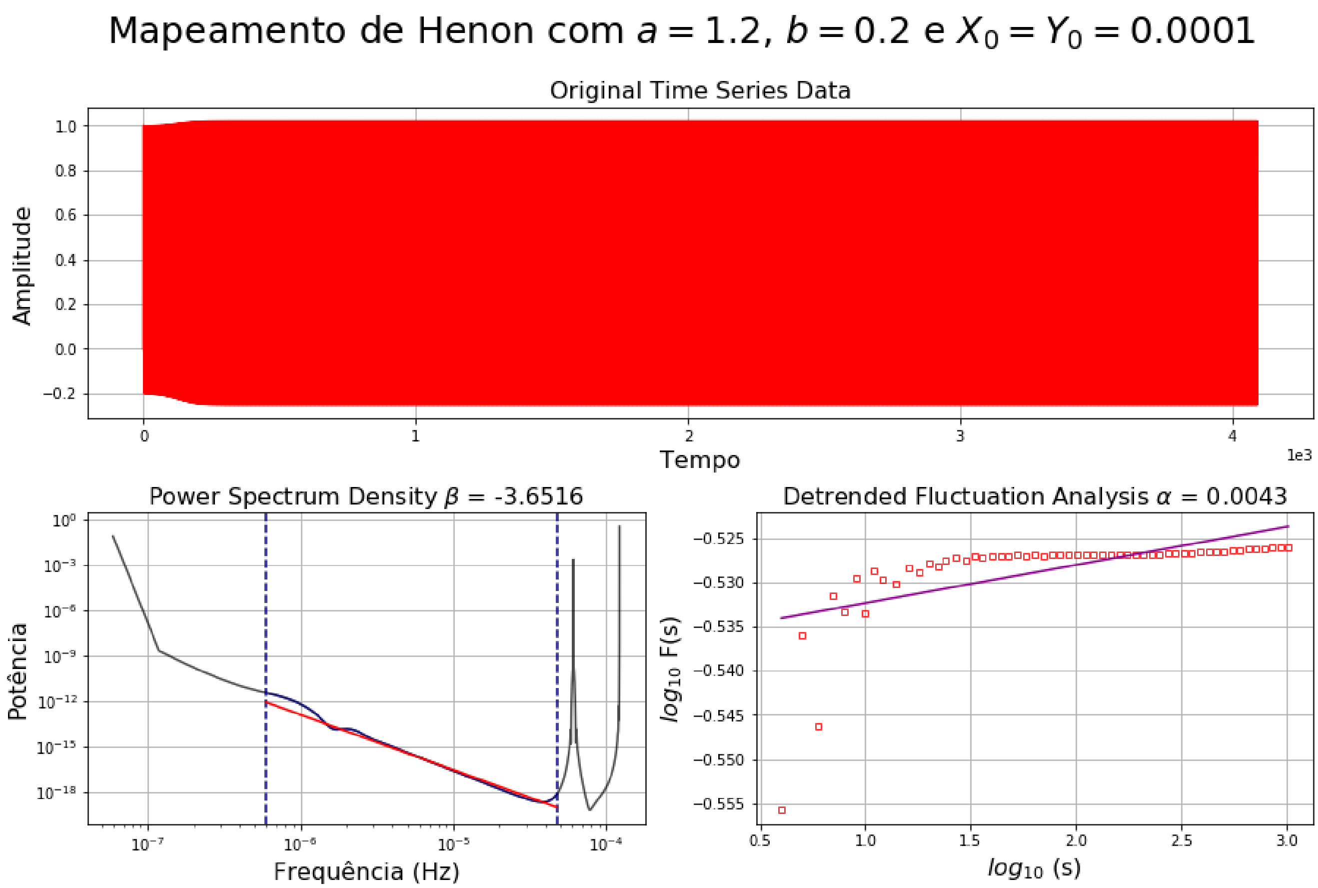
```
In [11]: aux.plot_estimated_autocorrelation(t, A, 0, len(A))
```



1.9 Plotando DFA e PSD

```
In [12]: aux.plot_psd_dfa(A, 'Mapeamento de Henon com $a=1.2$, $b=0.2$ e $X_0=Y_0=0.0001$')
```

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

First 10 points: [  1.00000000e-04   1.00001999e+00  -2.00043972e-01   9.91979691e-01
  -1.88830207e-01   9.96890971e-01  -2.00103138e-01   9.91826120e-01
  -1.88466988e-01   9.97049278e-01]


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



2 Analise dos primeiros 1024 pontos

In [13]:
```
A = save_A[1024:]
name = "A.ex:1.2.b"
savetxt(name + ".txt", A)
```

2.1 Calculando os momentos do ensemble

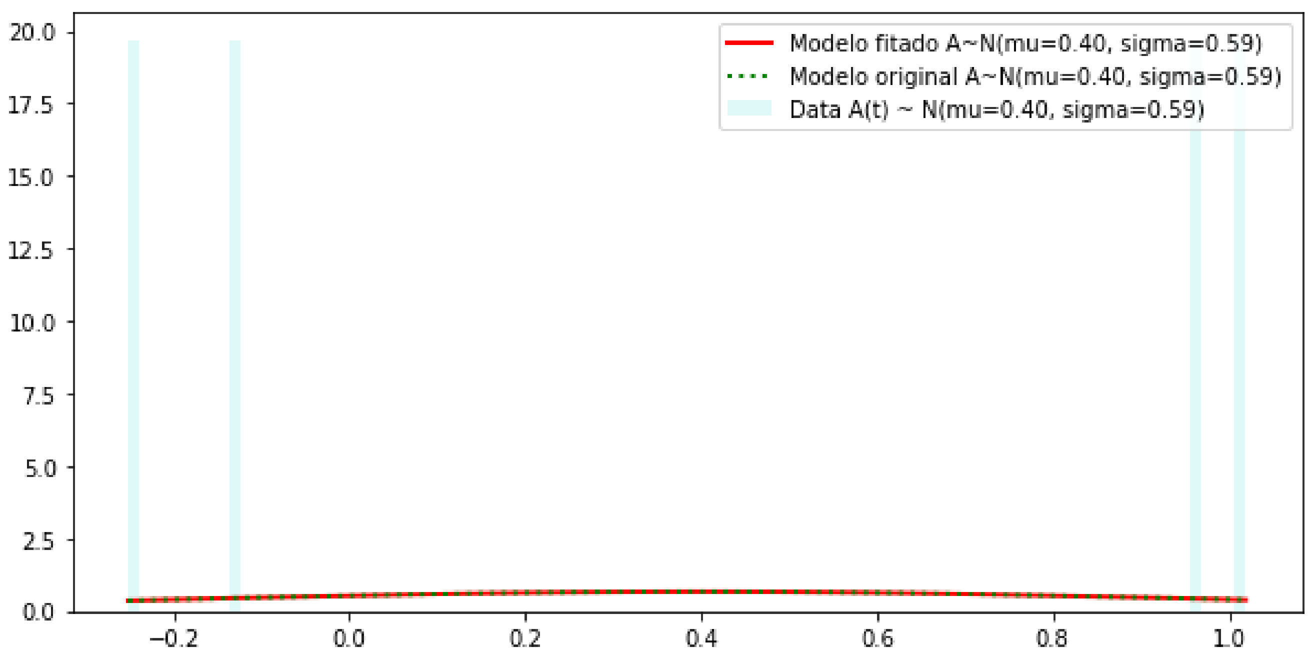
In [14]:
```
A_mean, A_var, A_skew, A_kurtosis = aux.calcMoments(A)

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 :  0.401341559762
var  :  0.351185037931
skew :  -0.0134927201204
kurt :  -1.9735921299
Q1   :  -0.158003256807
Q3   :  0.978309334756
```

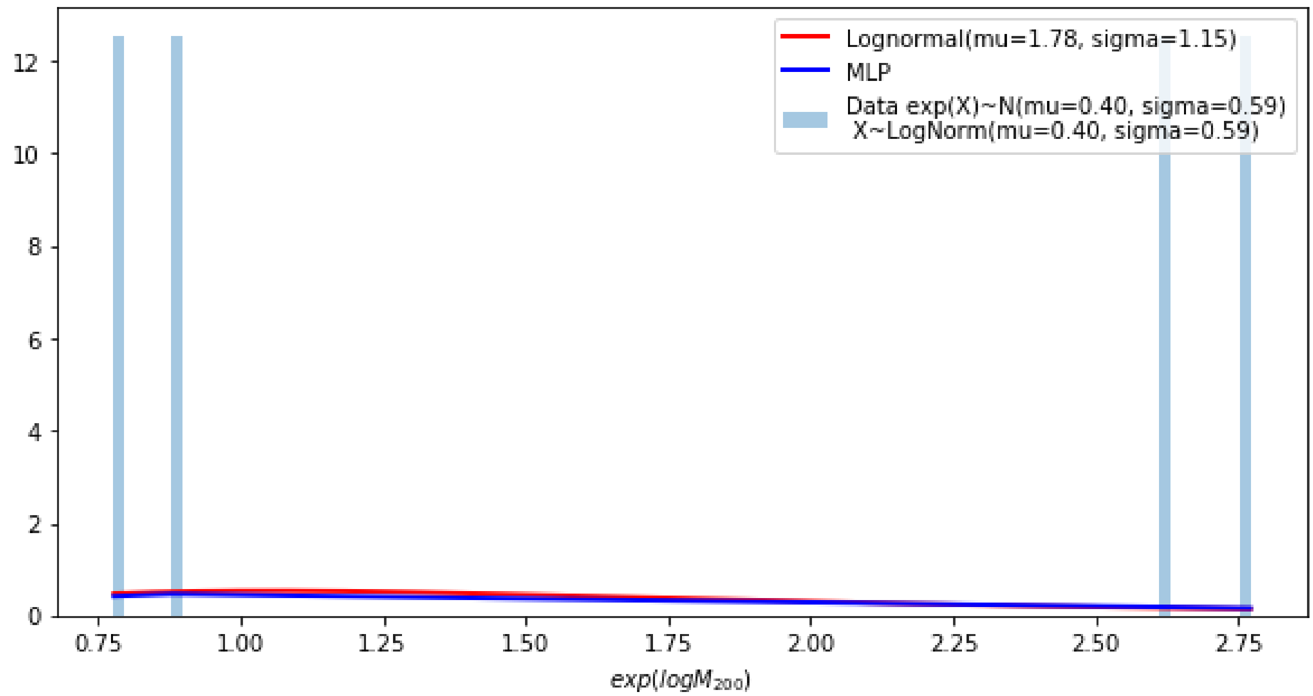
2.2 Fitando uma distribuição normal

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



2.3 Fitando uma distribuição lognormal

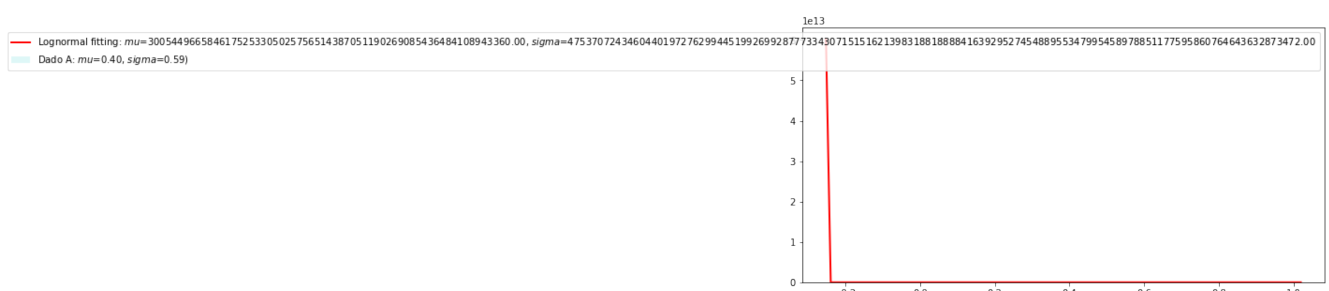
```
In [16]: aux.fitting_lognormal_and_mlp_distribution(A)
```



2.4 Fitando uma distribuição lognormal (utlizando minha implementação)

```
In [17]: aux.fitting_lognormal_distribution(A)
```

```
parametros de fitting:  (16.924465921001211, -0.25188173620479981, 0.019001438732603886)
        Fitado                         Original
mean :  3.0054496658461753e+60          0.401341559762
var  :  2.2597732556528257e+245          0.351185037931
skew :  3.957026145573068e+186          -0.013492720120356697
kurt :  inf          -1.9735921298968766


/usr/lib64/python3.4/site-packages/numpy/lib/polynomial.py:680: RuntimeWarning: overflow encountered in
  y = y * x + p[i]
```



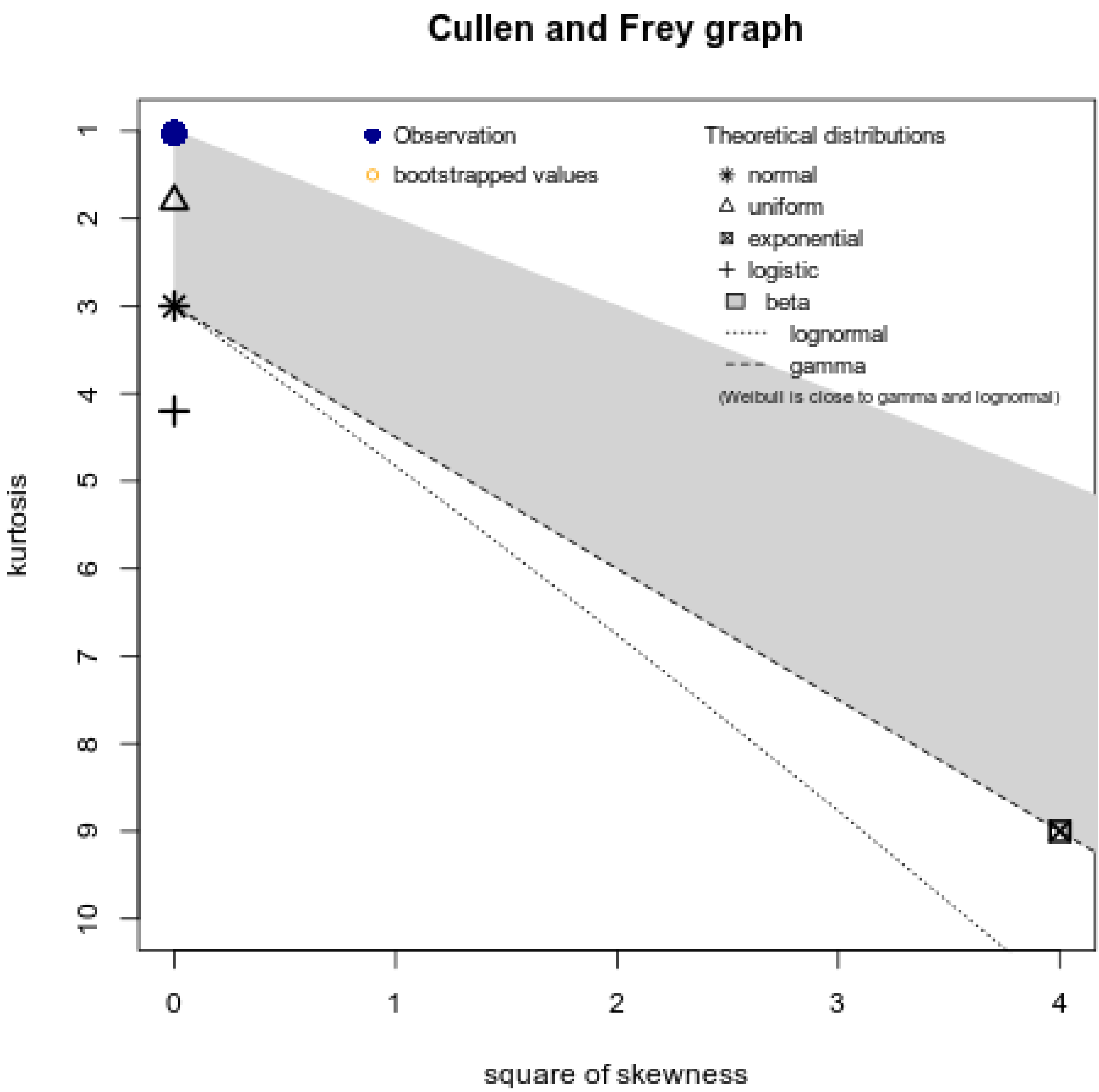
2.5 Plotando dados no espaço de Cullen-Frey

```
In [18]: command = 'Rscript'
         path_script = 'cullen_frey_script.R'
```

```python
    # 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:  -0.2518817   max:  1.019319
median:  0.4189645
mean:  0.4013416
estimated sd:  0.5927051
estimated skewness:  -0.01349931
estimated kurtosis:  1.025148
```

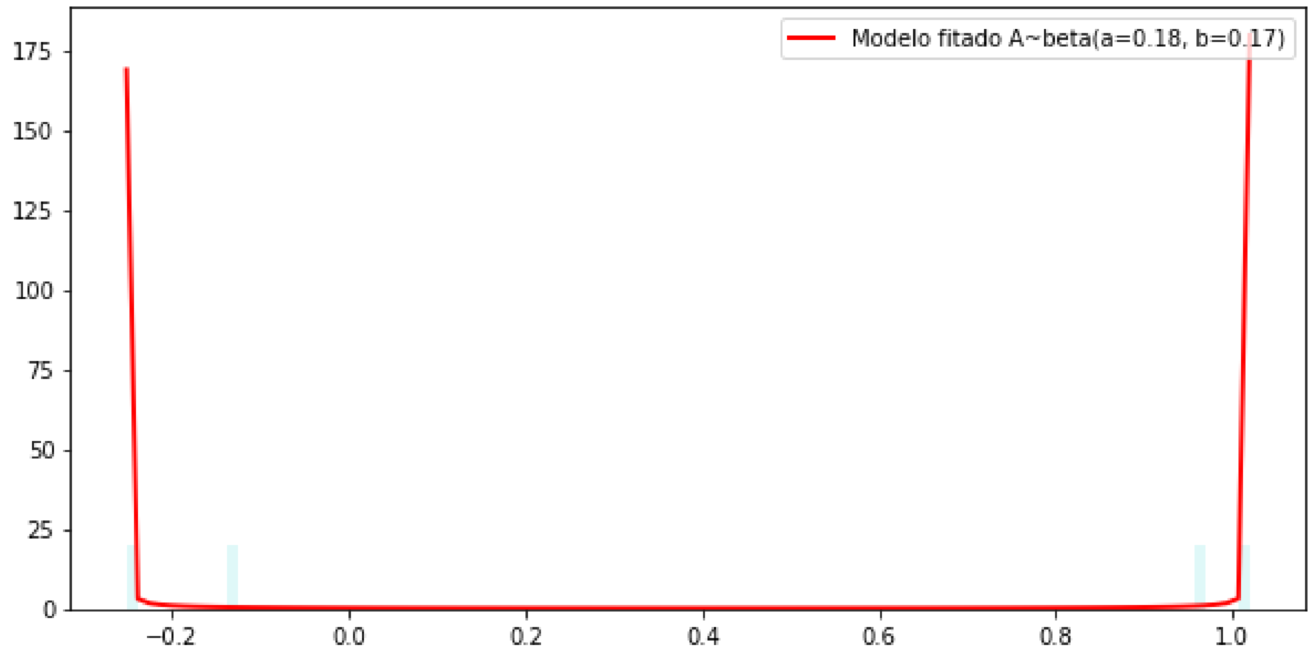
Out[18]:



2.6 Fitando melhor distribuição segundo método de Cullen-Frey

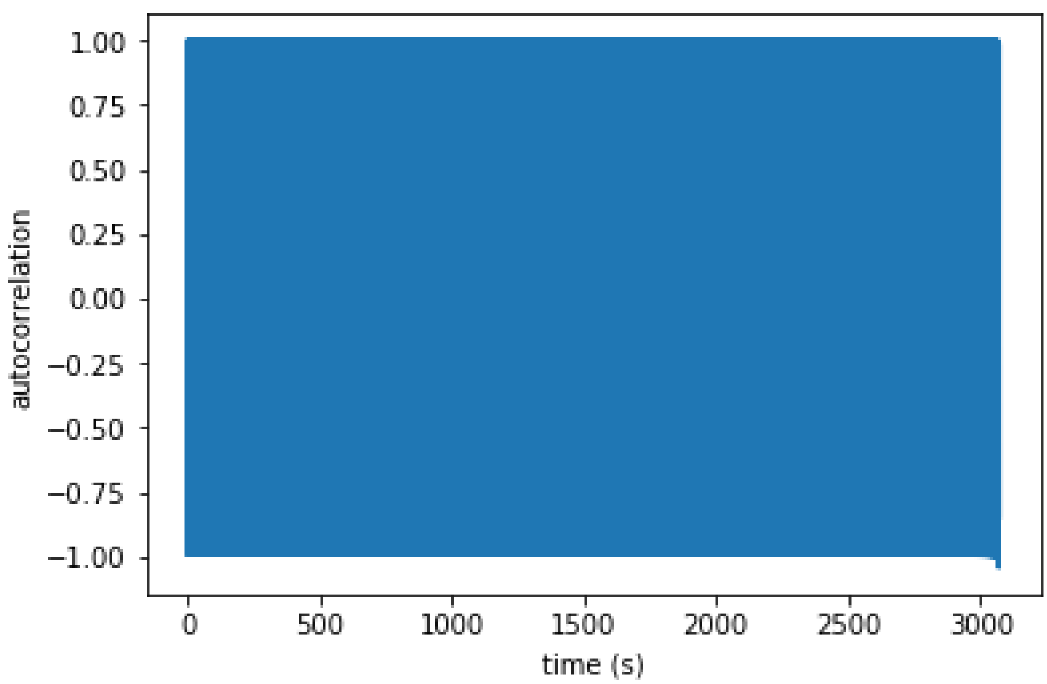
```
In [19]: aux.fitting_beta_distribution(A)
```

```
parametros de fitting:  (0.17843475888224822, 0.17189606553329972, -0.25198173620479974, 1.2714006750847
        Fitado                        Original
mean :  0.39558352808486513         0.401341559762
var  :  0.29916679332237217         0.351185037931
skew :  -0.03691810180237319         -0.013492720120356697
kurt :  -1.7894337163565226         -1.9735921298968766
```



2.7 Calculando autocorrelação

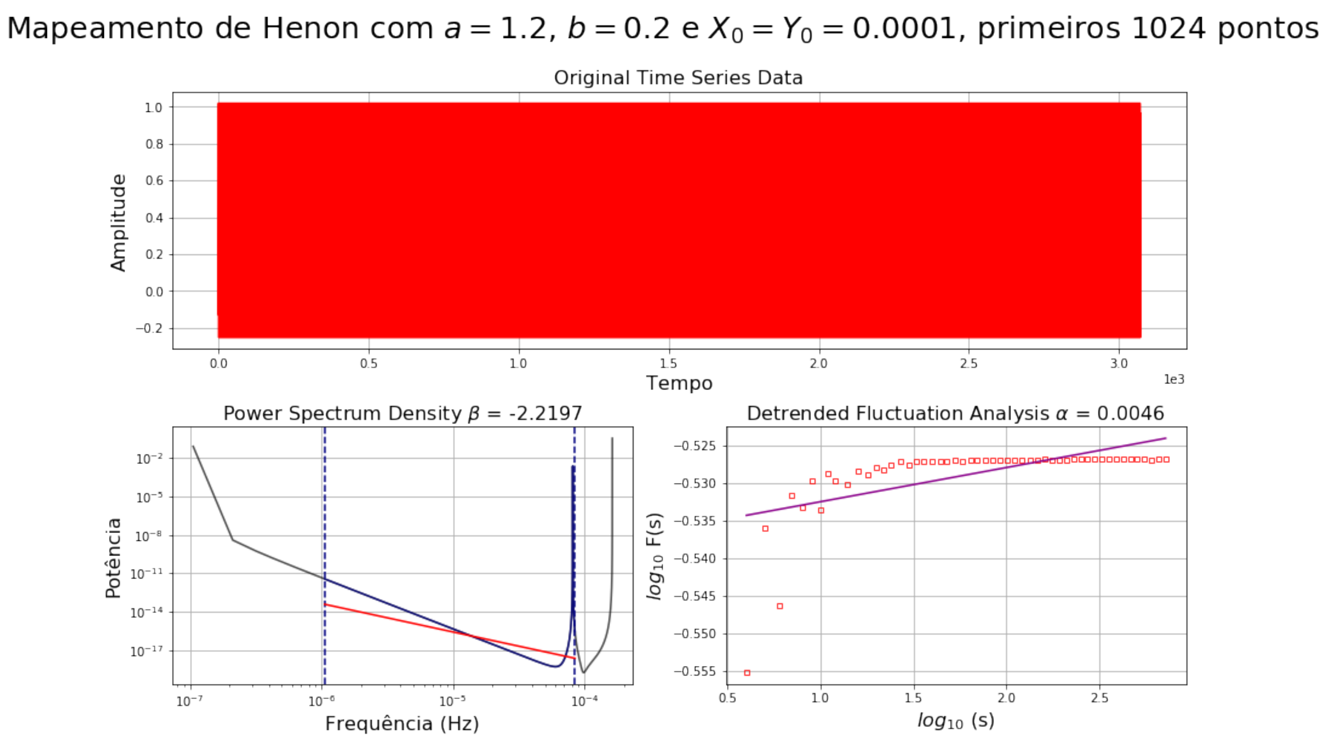
```
In [20]: aux.plot_estimated_autocorrelation(t, A, 0, len(A))
```



2.8 Plotando DFA e PSD

```
In [21]: aux.plot_psd_dfa(A, 'Mapeamento de Henon com $a=1.2$, $b=0.2$ e $X_0=Y_0=0.0001$, primeiros 102
```

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

First 10 points: [-0.12671043  1.01931894 -0.25188174  0.96463947 -0.12671043  1.01931894
 -0.25188174  0.96463947 -0.12671043  1.01931894]


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



3 Analise dos últimos 1024 pontos

In [22]:
```python
A = save_A[3*1024:4096]
name = "A.ex:1.2.b"
savetxt(name + ".txt", A)
```

In [23]:
```python
A.shape
```

Out[23]: (1024,)

3.1 Calculando os momentos do ensemble

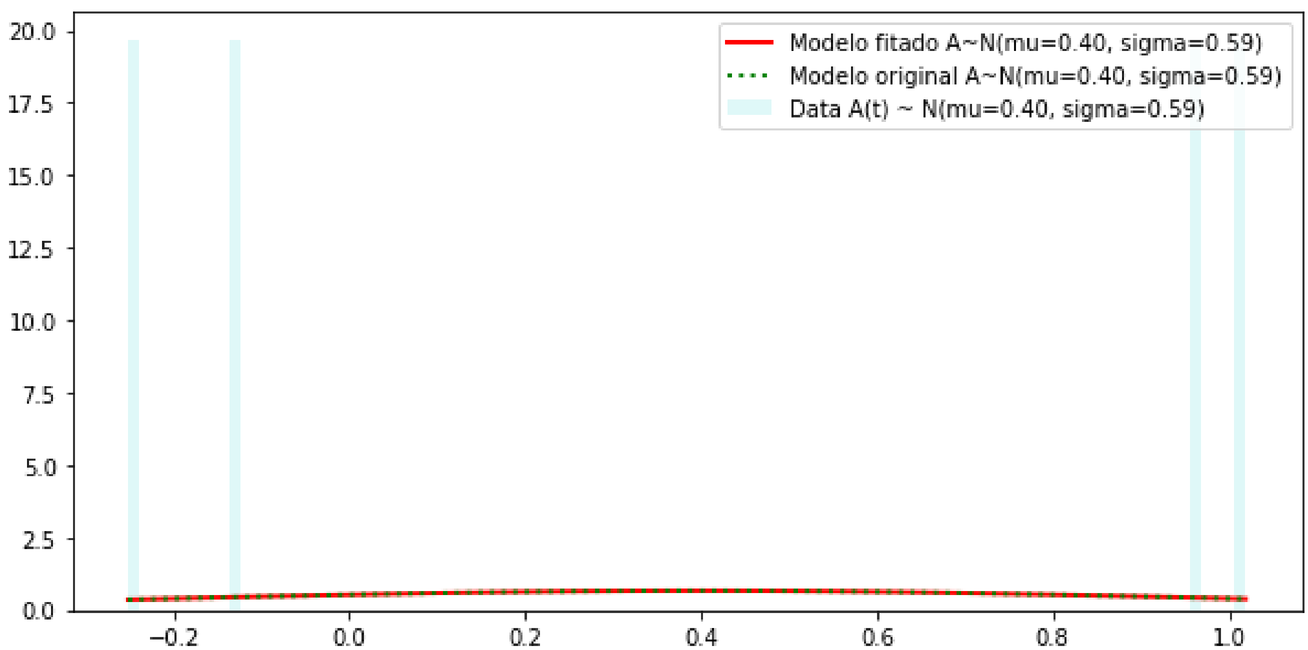
In [24]:
```python
A_mean, A_var, A_skew, A_kurtosis = aux.calcMoments(A)

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 :  0.401341559762
var  :  0.351185037931
skew :  -0.0134927201204
kurt :  -1.9735921299
Q1   :  -0.158003256807
Q3   :  0.978309334756
```

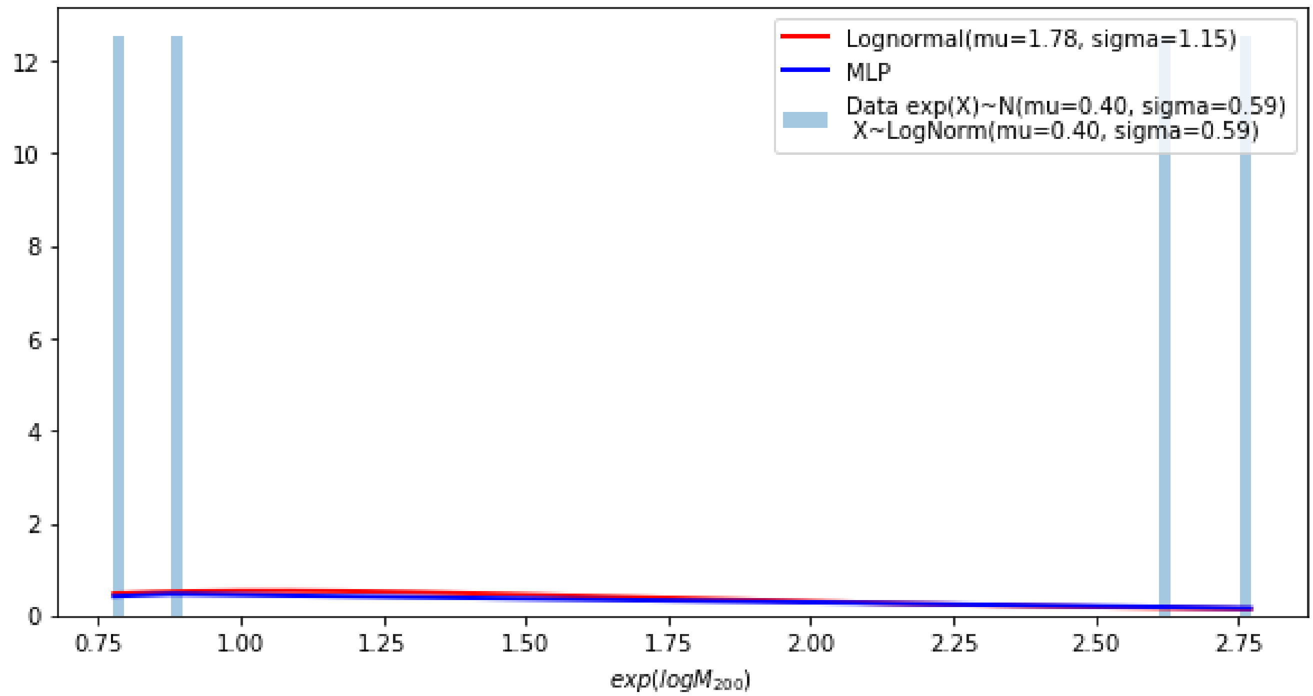
3.2 Fitando uma distribuição normal

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



3.3 Fitando uma distribuição lognormal

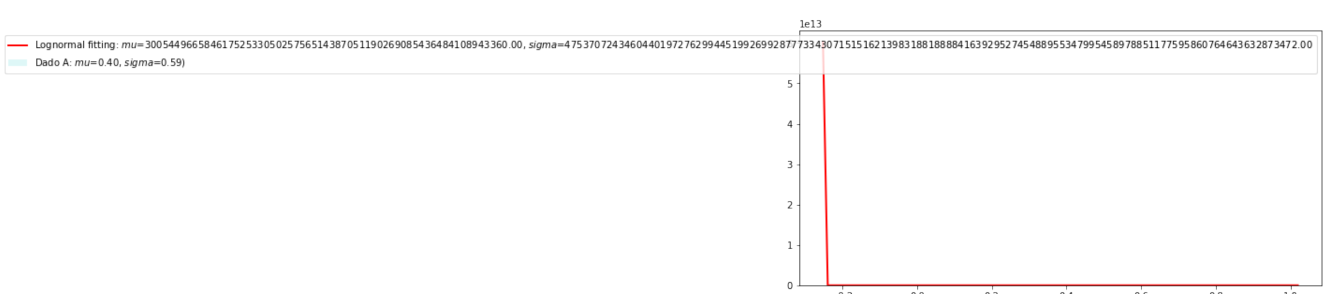
In [26]: `aux.fitting_lognormal_and_mlp_distribution(A)`



3.4 Fitando uma distribuição lognormal (utlizando minha implementação)

```
In [27]: aux.fitting_lognormal_distribution(A)
```

```
parametros de fitting:  (16.924465921001211, -0.25188173620479981, 0.019001438732603886)
        Fitado                         Original
mean :  3.0054496658461753e+60          0.401341559762
var  :  2.2597732556528257e+245          0.351185037931
skew :  3.957026145573068e+186          -0.013492720120357241


/usr/lib64/python3.4/site-packages/numpy/lib/polynomial.py:680: RuntimeWarning: overflow encountered in
  y = y * x + p[i]


kurt :  inf          -1.973592129896877
```

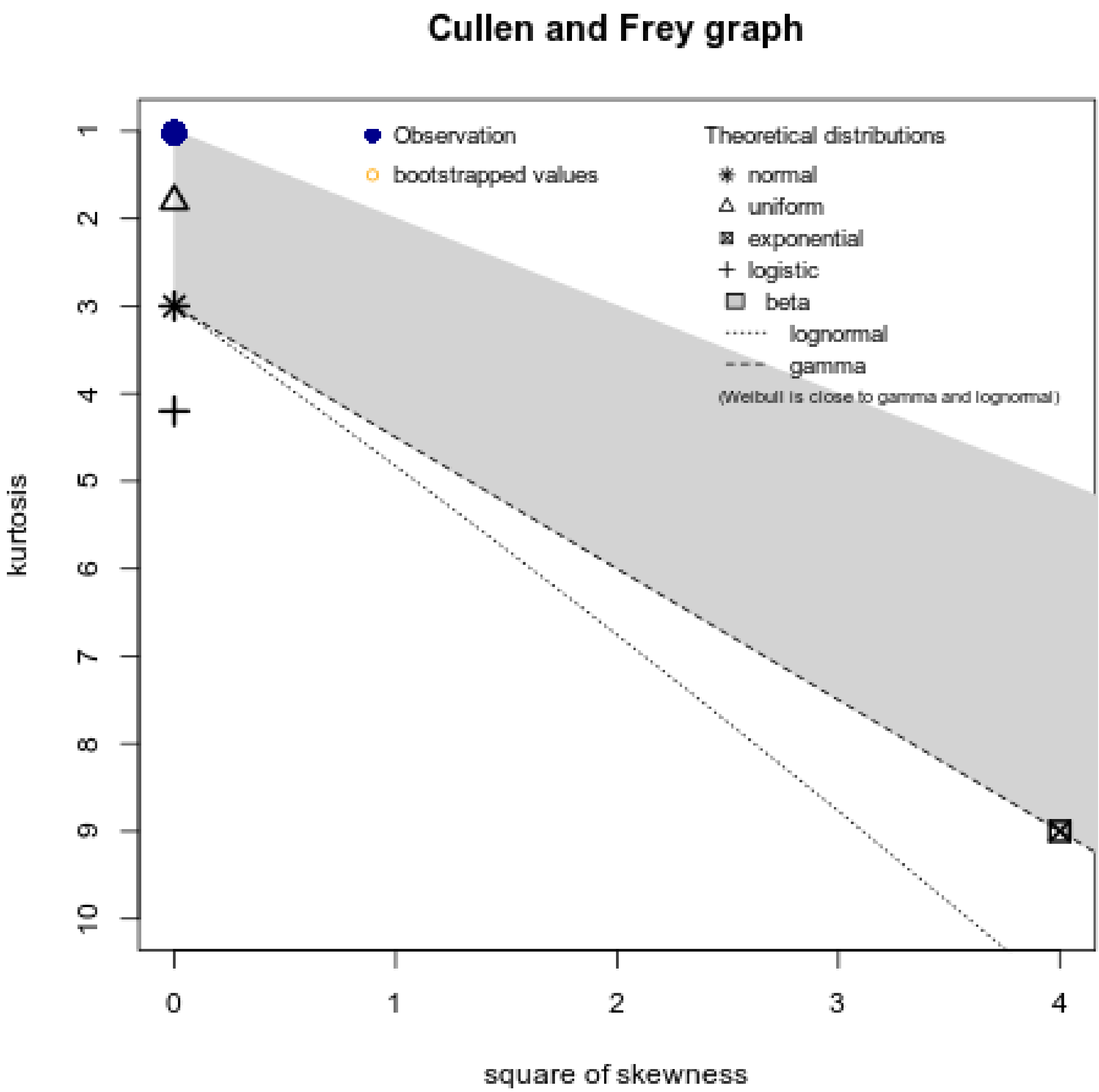


3.5 Plotando dados no espaço de Cullen-Frey

In [28]:
```
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:  -0.2518817   max:  1.019319
median:  0.4189645
mean:  0.4013416
estimated sd:  0.5928982
estimated skewness:  -0.01351252
estimated kurtosis:  1.02262
```

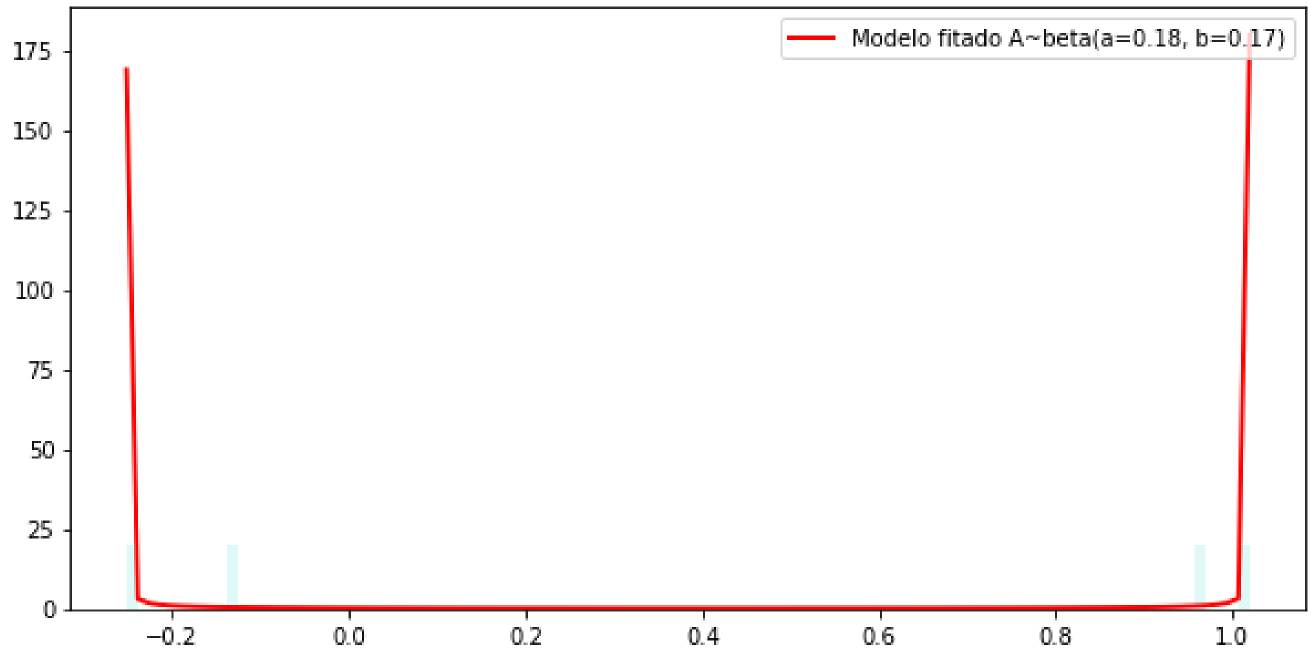
Out[28]:



3.6 Fitando melhor distribuição segundo método de Cullen-Frey

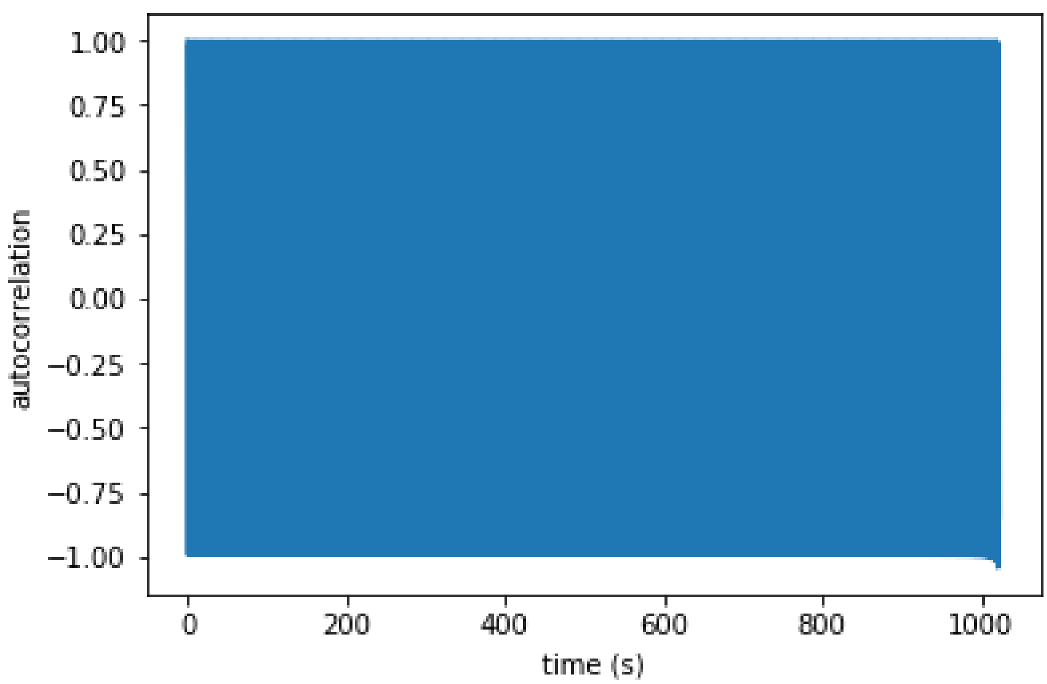
```
In [29]: aux.fitting_beta_distribution(A)
```

```
parametros de fitting:  (0.17843475888224791, 0.17189606553330006, -0.25198173620479974, 1.2714006750847
        Fitado                          Original
mean :  0.395583528084864           0.401341559762
var  :  0.2991667933223723           0.351185037931
skew :  -0.03691810180236958          -0.013492720120357241
kurt :  -1.7894337163565224          -1.973592129896877
```



3.7 Calculando autocorrelação

```
In [30]: aux.plot_estimated_autocorrelation(t, A, 0, len(A))
```



3.8 Plotando DFA e PSD

```
In [31]: aux.plot_psd_dfa(A, 'Mapeamento de Henon com $a=1.2$, $b=0.2$ e $X_0=Y_0=0.0001$, últimos 1024
```

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

First 10 points: [-0.12671043  1.01931894 -0.25188174  0.96463947 -0.12671043  1.01931894
 -0.25188174  0.96463947 -0.12671043  1.01931894]


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