Simulaciones_Montecarlo

June 16, 2022

[1]:

```
!pip install fitter
!pip install xlrd
from scipy import stats
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import matplotlib as mpl
import math
from google.colab import drive
drive.mount('/content/drive')
from random import random
import os
import pandas as pd
from fitter import Fitter, get_common_distributions
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-
wheels/public/simple/
Collecting fitter
  Downloading fitter-1.4.0.tar.gz (27 kB)
Collecting easydev
  Downloading easydev-0.12.0.tar.gz (47 kB)
     |                 | 47 kB 3.9 MB/s
Requirement already satisfied: numpy in /usr/local/lib/python3.7/dist-
packages (from fitter) (1.21.6)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.7/dist-
packages (from fitter) (3.2.2)
Requirement already satisfied: scipy>=0.18 in /usr/local/lib/python3.7/dist-
packages (from fitter) (1.4.1)
Requirement already satisfied: pandas in /usr/local/lib/python3.7/dist-packages
(from fitter) (1.3.5)
Requirement already satisfied: click in /usr/local/lib/python3.7/dist-packages
(from fitter) (7.1.2)
Requirement already satisfied: joblib in /usr/local/lib/python3.7/dist-packages
(from fitter) (1.1.0)
Collecting colorama
  Downloading colorama-0.4.5-py2.py3-none-any.whl (16 kB)
Requirement already satisfied: pexpect in /usr/local/lib/python3.7/dist-packages
(from easydev->fitter) (4.8.0)
```

```
Collecting colorlog
  Downloading colorlog-6.6.0-py2.py3-none-any.whl (11 kB)
Requirement already satisfied: kiwisolver>=1.0.1 in
/usr/local/lib/python3.7/dist-packages (from matplotlib->fitter) (1.4.2)
Requirement already satisfied: python-dateutil>=2.1 in
/usr/local/lib/python3.7/dist-packages (from matplotlib->fitter) (2.8.2)
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in
/usr/local/lib/python3.7/dist-packages (from matplotlib->fitter) (3.0.9)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.7/dist-
packages (from matplotlib->fitter) (0.11.0)
Requirement already satisfied: typing-extensions in
/usr/local/lib/python3.7/dist-packages (from
kiwisolver>=1.0.1->matplotlib->fitter) (4.2.0)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-
packages (from python-dateutil>=2.1->matplotlib->fitter) (1.15.0)
Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.7/dist-
packages (from pandas->fitter) (2022.1)
Requirement already satisfied: ptyprocess>=0.5 in /usr/local/lib/python3.7/dist-
packages (from pexpect->easydev->fitter) (0.7.0)
Building wheels for collected packages: fitter, easydev
  Building wheel for fitter (setup.py) … done
  Created wheel for fitter: filename=fitter-1.4.0-py3-none-any.whl size=25026
sha256=586746222fa3d1f9cf0c1a7f9a5b9c2a487ea70bb2e1ca838afd617f6e25e5f0
  Stored in directory: /root/.cache/pip/wheels/e1/98/16/e5263962f94fbfaad79902aa
94652516caccc1f1d51509e853
  Building wheel for easydev (setup.py) … done
  Created wheel for easydev: filename=easydev-0.12.0-py3-none-any.whl size=64232
sha256=b02e2d26aca6f435508c45cd3e31ab4ac1cd1b263ad79ed437d787ddbf1123de
  Stored in directory: /root/.cache/pip/wheels/82/ab/83/fdfc4017ea44a585b6754752
cc5f63f2d0d63fcc1317e7174b
Successfully built fitter easydev
Installing collected packages: colorlog, colorama, easydev, fitter
Successfully installed colorama-0.4.5 colorlog-6.6.0 easydev-0.12.0 fitter-1.4.0
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-
wheels/public/simple/
Requirement already satisfied: xlrd in /usr/local/lib/python3.7/dist-packages
(1.1.0)
Mounted at /content/drive
```

[2]:

```
mpl.style.use('ggplot')
```

[3]:

```
df = pd.read_excel("/content/drive/MyDrive/DatosMP4.xlsx")
df.head()
```

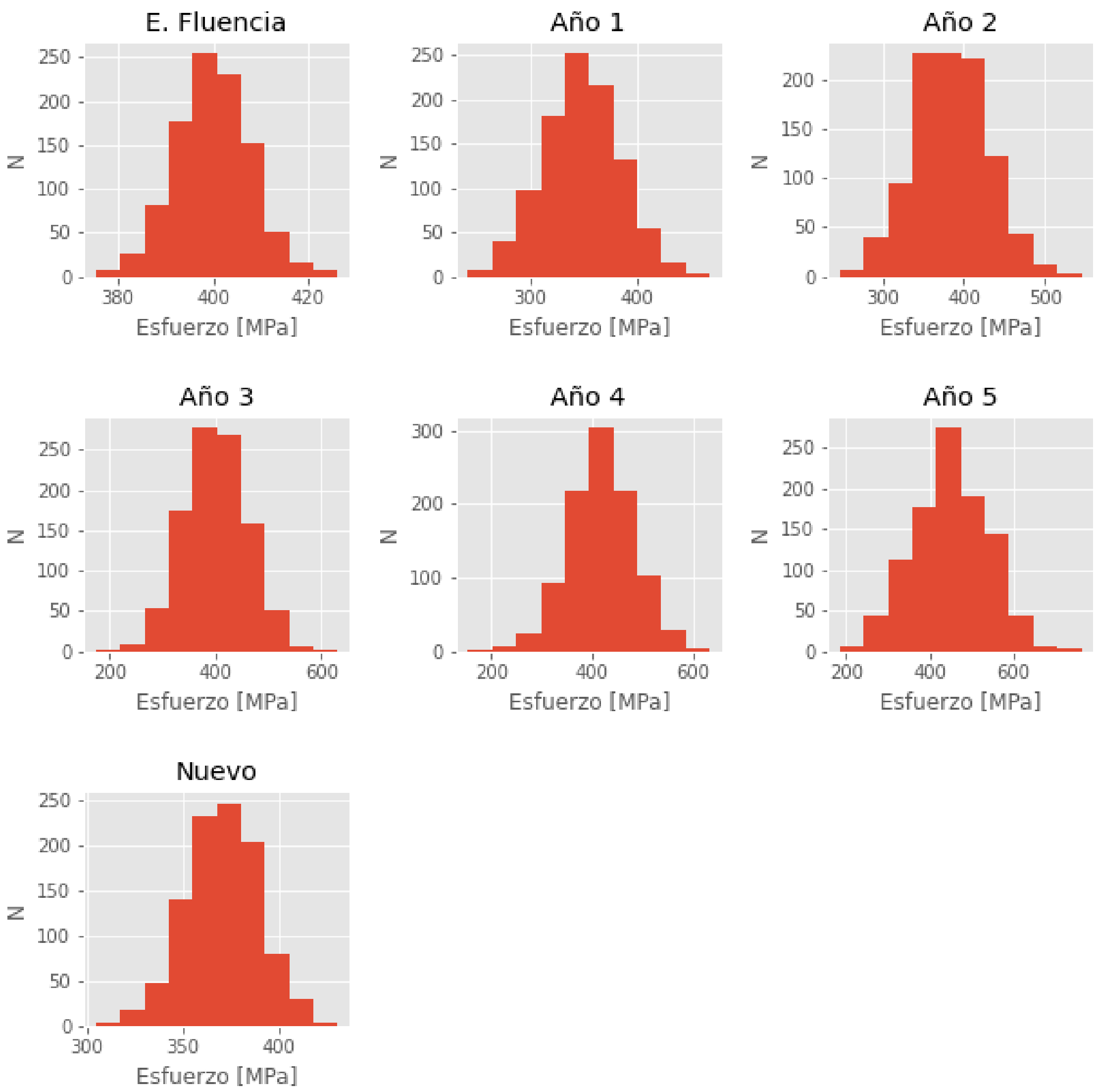
[3]:

```
   Esfuerzo de Fluencia [MPa]  Esfuerzo de Von Mises Año 1 [MPa]  \
0                  409.772785                         286.267135
1                  399.368044                         362.560712
```

```
2                  379.098797                         376.878376
3                  397.319403                         345.521110
4                  389.610689                         363.136814

   Esfuerzo de Von Mises Año 2 [MPa]  Esfuerzo de Von Mises Año 3 [MPa]  \
0                         379.410636                         420.885307
1                         471.182364                         328.561081
2                         349.535479                         343.778351
3                         351.357658                         330.009833
4                         417.375399                         354.024888

   Esfuerzo de Von Mises Año 4 [MPa]  Esfuerzo de Von Mises Año 5 [MPa]  \
0                         547.322699                         424.137764
1                         328.929920                         530.896426
2                         422.346981                         428.814650
3                         330.643330                         415.633807
4                         358.917737                         374.990289

   Esfuerzo de Von Mises Nuevo [MPa]
0                         370.603273
1                         371.720294
2                         360.982653
3                         379.564945
4                         359.259070
```

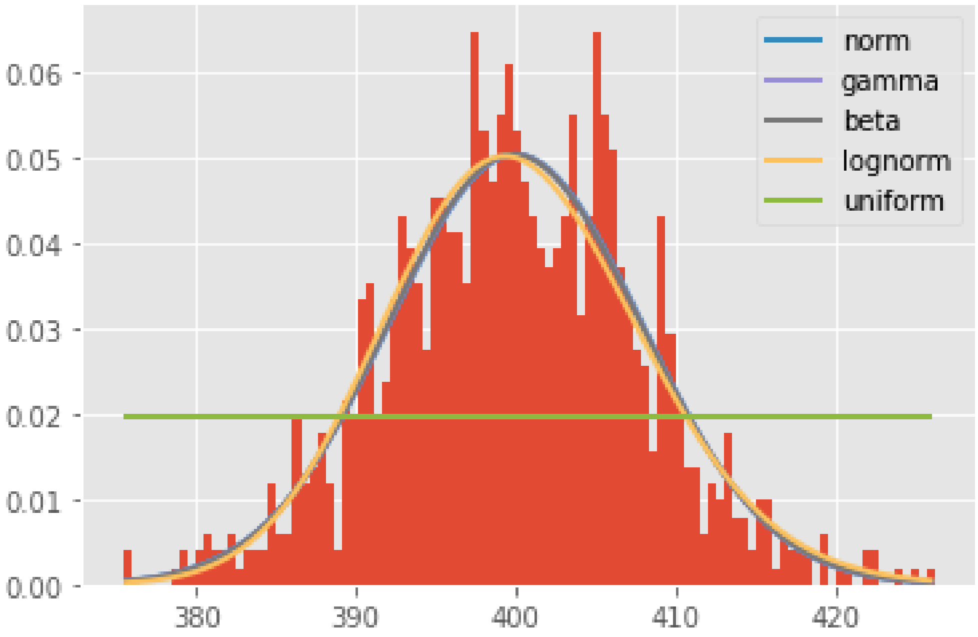
[4]:

```
graph_names = ['E. Fluencia','Año 1','Año 2','Año 3','Año 4','Año 5','Nuevo']
b_a = ["Esfuerzo de Fluencia [MPa]",
       "Esfuerzo de Von Mises Año 1 [MPa]",
       "Esfuerzo de Von Mises Año 2 [MPa]",
       "Esfuerzo de Von Mises Año 3 [MPa]",
       "Esfuerzo de Von Mises Año 4 [MPa]",
       "Esfuerzo de Von Mises Año 5 [MPa]",
       "Esfuerzo de Von Mises Nuevo [MPa]"]
fig0 = plt.figure("Histogramas", figsize=(10,10))
fig0.subplots_adjust(hspace=0.6, wspace=0.4)
for i in range(1,len(graph_names)+1):
  ax2 = fig0.add_subplot(3, 3, i)
  df[f"{b_a[i-1]}"].hist()
  ax2.set_title(graph_names[i-1])
  plt.xlabel('Esfuerzo [MPa]')
  plt.ylabel('N')
```



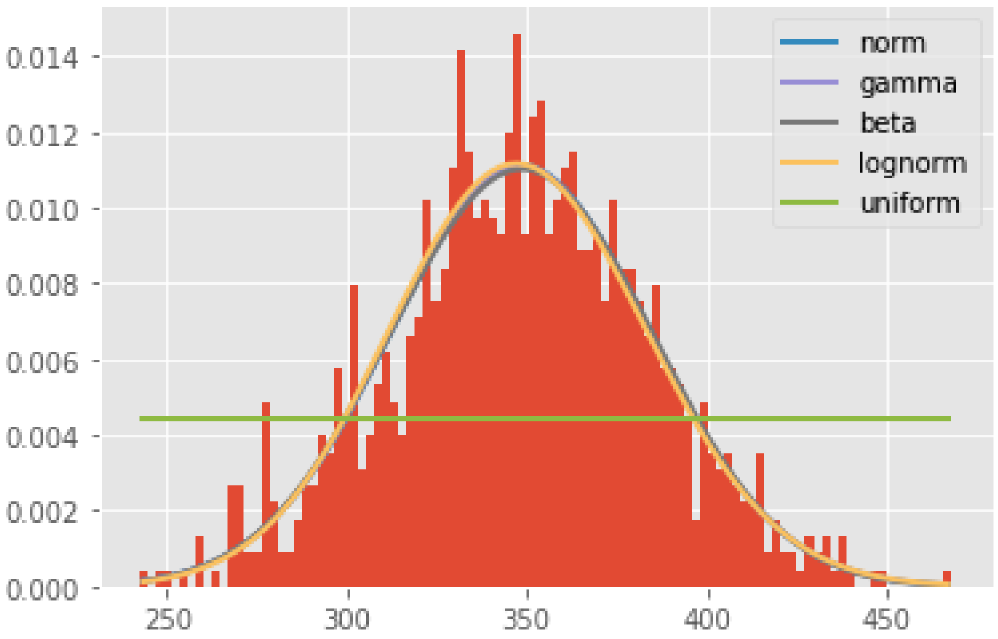
```
[5]: f_Ef = Fitter(df["Esfuerzo de Fluencia [MPa]"], distributions =␣
      ↪['gamma','beta','lognorm','expon','uniform','norm'])
     f_Ef.fit()
     f_Ef.summary()
     f_Ef.get_best(method='sumsquare_error')
     f_Ef_params = f_Ef.fitted_param["norm"]
     print('Parametros Esfuerzo fluencia: ',f_Ef_params)
```

```
Parametros Esfuerzo fluencia:  (400.02482908039343, 7.91103861569235)
```



```
[6]: f_vm1 = Fitter(df["Esfuerzo de Von Mises Año 1 [MPa]"], distributions =␣
      ↪['gamma','beta','lognorm','expon','uniform','norm'])
     f_vm1.fit()
     f_vm1.summary()
     f_vm1.get_best(method='sumsquare_error')
     f_vm1_params = f_vm1.fitted_param["norm"]
     print('Parametros Von Mises 1: ',f_vm1_params)
```

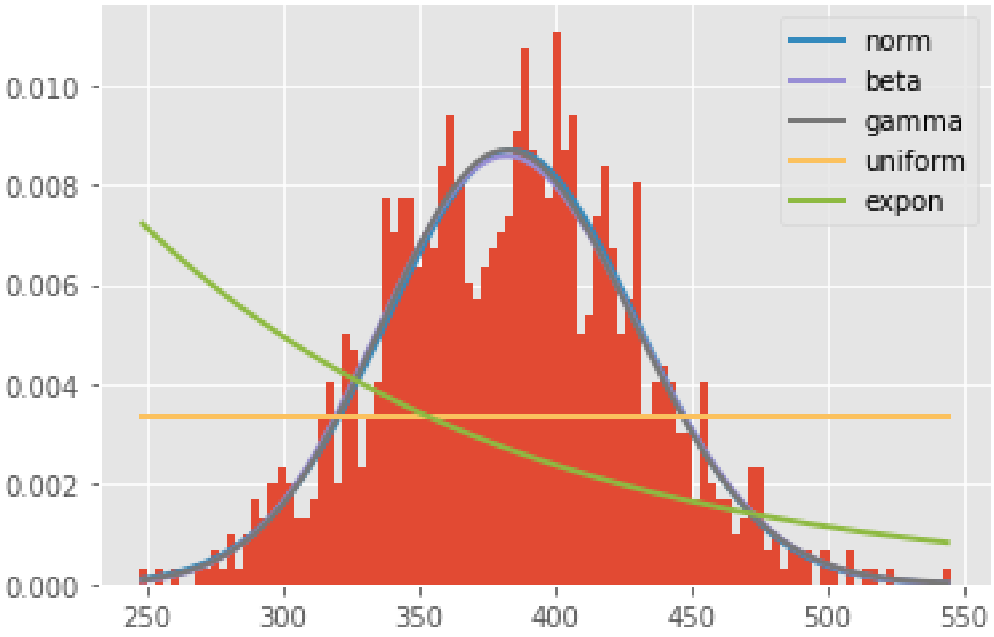
```
Parametros Von Mises 1:  (348.3434273769656, 35.8483331629444)
```



[7]:

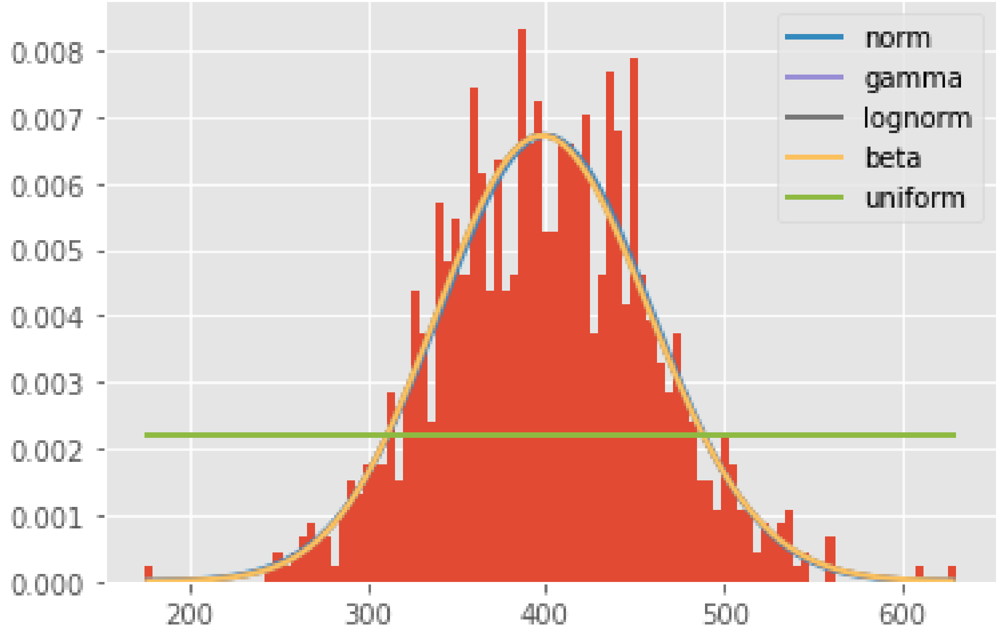
```
f_vm2 = Fitter(df["Esfuerzo de Von Mises Año 2 [MPa]"], distributions =␣
 ↪['gamma','beta','lognorm','expon','uniform','norm'])
f_vm2.fit()
f_vm2.summary()
f_vm2.get_best(method='sumsquare_error')
f_vm2_params = f_vm2.fitted_param["norm"]
print('Parametros Von Mises 2: ',f_vm2_params)
```

```
Parametros Von Mises 2:  (384.1322333746128, 45.86580023052795)
```



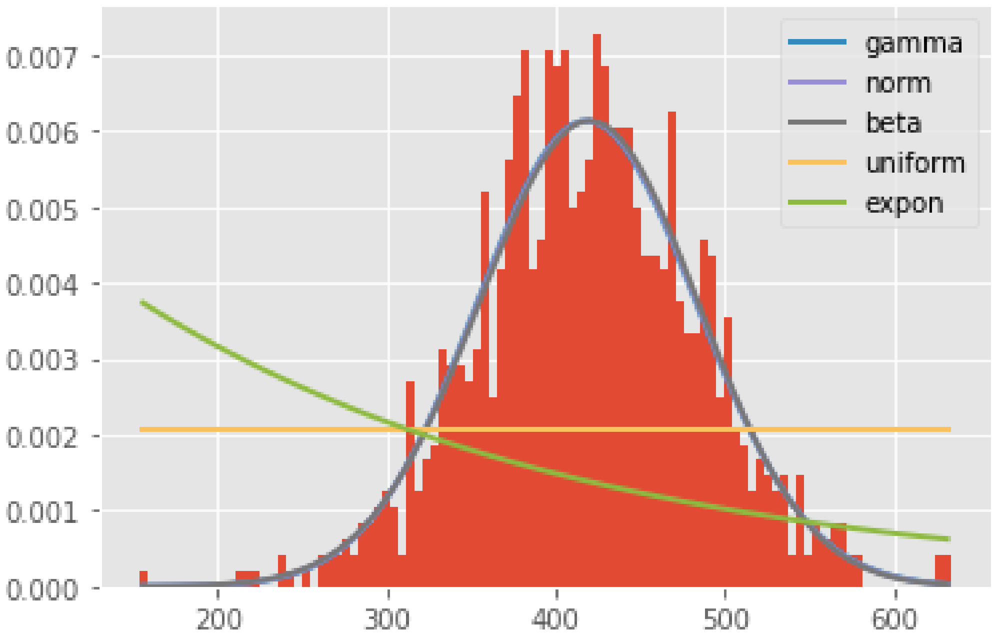
```
[8]: f_vm3 = Fitter(df["Esfuerzo de Von Mises Año 3 [MPa]"], distributions =␣
      ↪['gamma','beta','lognorm','expon','uniform','norm'])
     f_vm3.fit()
     f_vm3.summary()
     f_vm3.get_best(method='sumsquare_error')
     f_vm3_params = f_vm3.fitted_param["norm"]
     print('Parametros Von Mises 3: ',f_vm3_params)
```

```
Parametros Von Mises 3:  (400.2830877263884, 59.415859669422346)
```



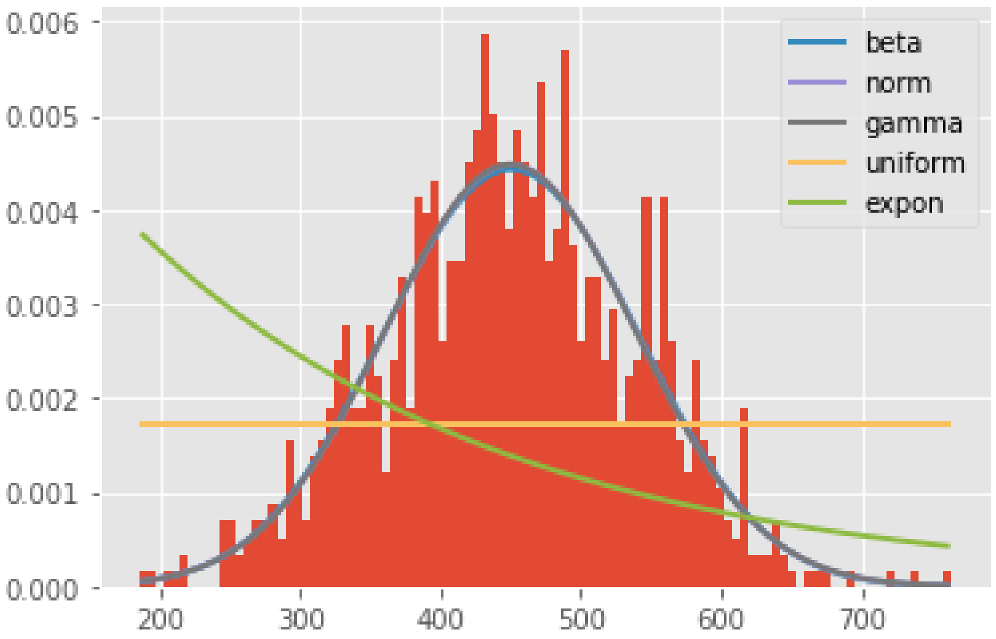
```
[9]: f_vm4 = Fitter(df["Esfuerzo de Von Mises Año 4 [MPa]"], distributions =␣
      ↪['gamma','beta','lognorm','expon','uniform','norm'])
     f_vm4.fit()
     f_vm4.summary()
     f_vm4.get_best(method='sumsquare_error')
     f_vm4_params = f_vm4.fitted_param["gamma"]
     print('Parametros Von Mises 4: ',f_vm4_params)
```

```
Parametros Von Mises 4:  (7164.369061061977, -5085.026094572892,
0.7682272126352068)
```



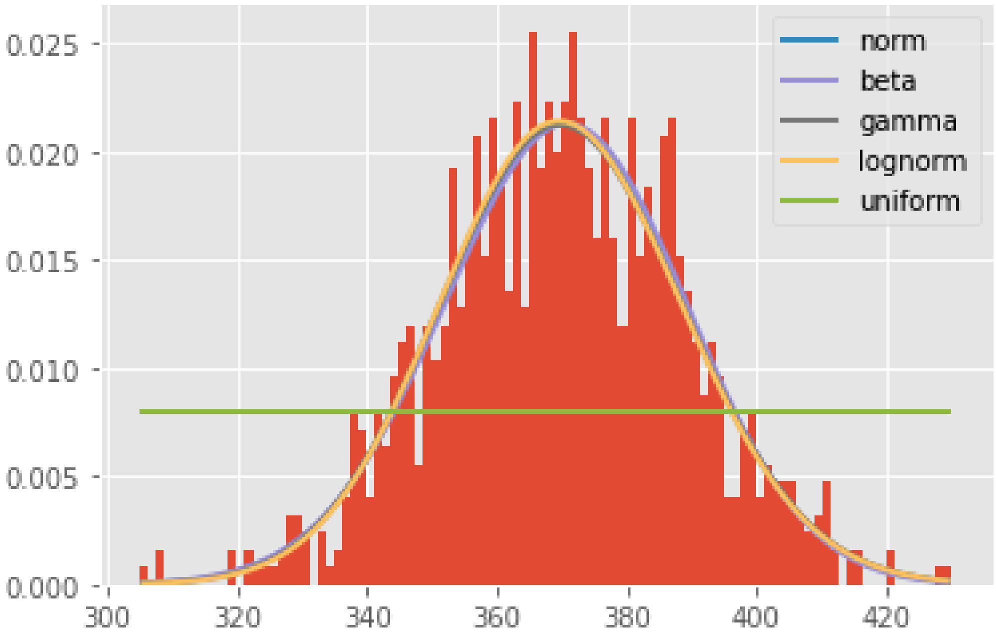
```
[10]: f_vm5 = Fitter(df["Esfuerzo de Von Mises Año 5 [MPa]"], distributions =␣
       ↪['gamma','beta','lognorm','expon','uniform','norm'])
      f_vm5.fit()
      f_vm5.summary()
      f_vm5.get_best(method='sumsquare_error')
      f_vm5_params = f_vm5.fitted_param["beta"]
      print('Parametros Von Mises 5: ',f_vm5_params)
```

```
Parametros Von Mises 5:  (31.93656483972588, 31.40984777290516,
-269.8686186788947, 1428.1550476803056)
```



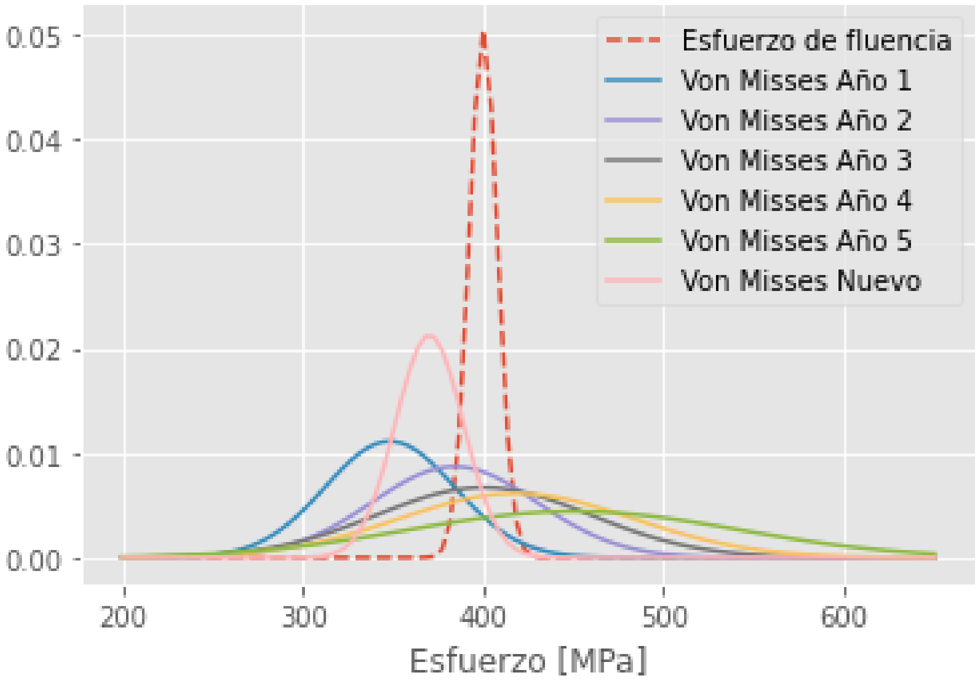
```
[11]: f_vmN = Fitter(df["Esfuerzo de Von Mises Nuevo [MPa]"], distributions =␣
       ↪['gamma','beta','lognorm','expon','uniform','norm'])
      f_vmN.fit()
      f_vmN.summary()
      f_vmN.get_best(method='sumsquare_error')
      f_vmN_params = f_vmN.fitted_param["norm"]
      print('Parametros Von Mises Nuevo: ',f_vmN_params)
```

```
Parametros Von Mises Nuevo:  (370.1793217541268, 18.732765037762416)
```



[12]:
```
x_p = np.linspace(200,650,100)
dist_Ef = stats.norm(loc= f_Ef_params[0], scale = f_Ef_params[1])
dist_vm1 = stats.norm(loc = f_vm1_params[0], scale = f_vm1_params[1])
dist_vm2 = stats.norm(loc = f_vm2_params[0], scale = f_vm2_params[1])
dist_vm3 = stats.norm(loc = f_vm3_params[0], scale = f_vm3_params[1])
dist_vm4 = stats.gamma(a = f_vm4_params[0],loc = f_vm4_params[1], scale =␣
 ↪f_vm4_params[2])
dist_vm5 = stats.beta(a = f_vm5_params[0],b = f_vm5_params[1],loc =␣
 ↪f_vm5_params[2], scale = f_vm5_params[3])
dist_vmN = stats.norm(loc = f_vmN_params[0], scale = f_vmN_params[1])
#############################################################################
```

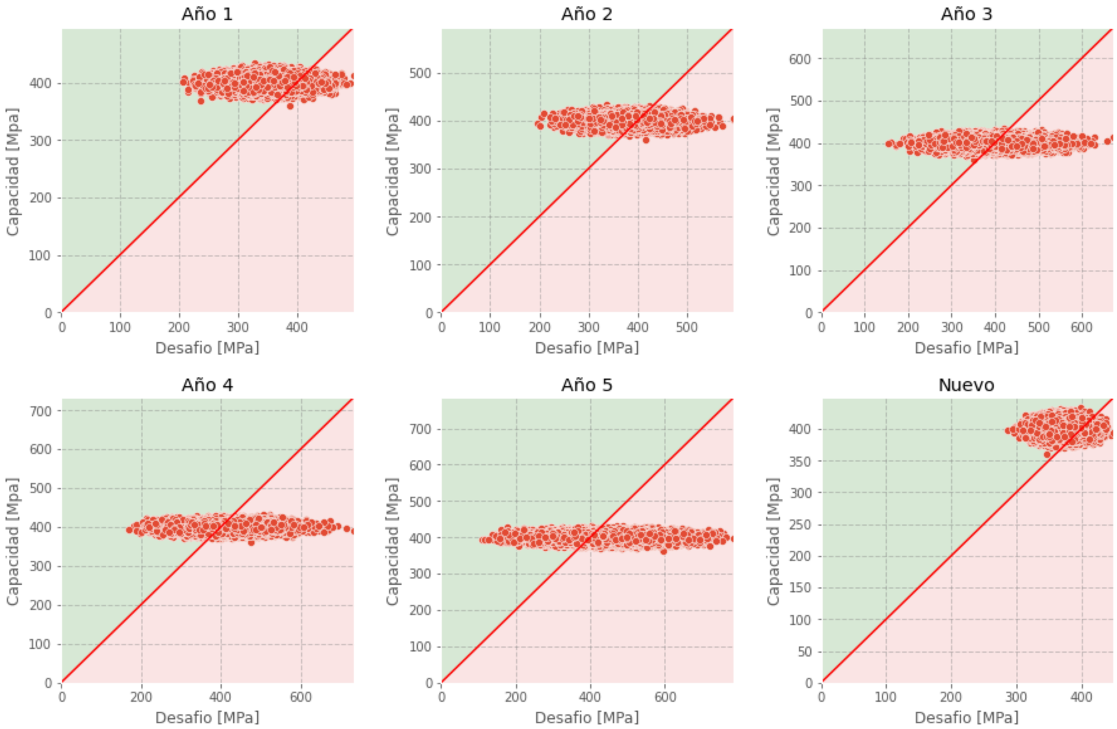
[13]:
```
plt.plot(x_p ,dist_Ef.pdf(x_p), label="Esfuerzo de fluencia", linestyle = '--')
plt.plot(x_p, dist_vm1.pdf(x_p), label="Von Misses Año 1")
plt.plot(x_p, dist_vm2.pdf(x_p), label="Von Misses Año 2")
plt.plot(x_p, dist_vm3.pdf(x_p), label="Von Misses Año 3")
plt.plot(x_p, dist_vm4.pdf(x_p), label="Von Misses Año 4")
plt.plot(x_p, dist_vm5.pdf(x_p), label="Von Misses Año 5")
plt.plot(x_p, dist_vmN.pdf(x_p), label="Von Misses Nuevo")
plt.xlabel('Esfuerzo [MPa]')
plt.legend()
plt.show()
```



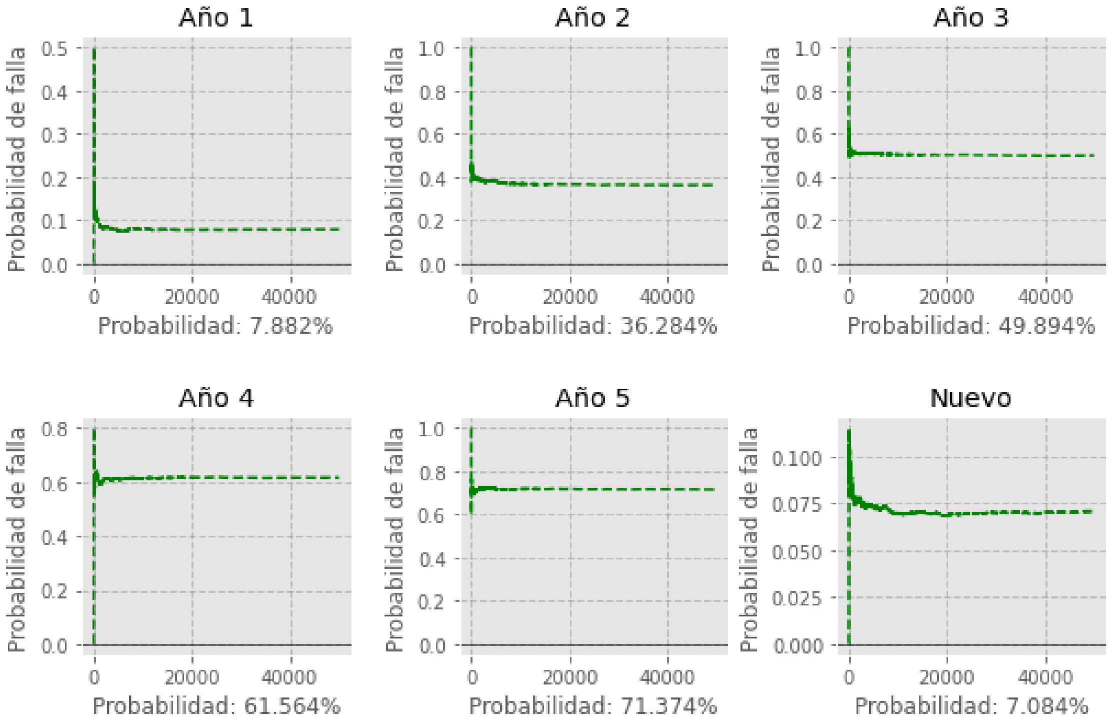
[14]:

```
N = 50000

Ef_r = stats.norm.rvs(loc= f_Ef_params[0], scale = f_Ef_params[1], size = N)
vm1_r = stats.norm.rvs(loc = f_vm1_params[0], scale = f_vm1_params[1], size = N)
vm2_r = stats.norm.rvs(loc = f_vm2_params[0], scale = f_vm2_params[1], size = N)
vm3_r = stats.norm.rvs(loc = f_vm3_params[0], scale = f_vm3_params[1], size = N)
vm4_r = stats.gamma.rvs(a = f_vm4_params[0],loc = f_vm4_params[1], scale =␣
 ↪f_vm4_params[2], size = N)
vm5_r = stats.beta.rvs(a = f_vm5_params[0],b = f_vm5_params[1],loc =␣
 ↪f_vm5_params[2], scale = f_vm5_params[3],size=N)
vmN_r = stats.norm.rvs(loc = f_vmN_params[0], scale = f_vmN_params[1], size = N)

##############  Ef - Vm <= 0
cont_vm1 = 0
prob_vm1 = []
for i in range(N):
  if Ef_r[i]-vm1_r[i] <= 0:
    cont_vm1 += 1
  prob_vm1.append(cont_vm1/(i+1))
  ###########
cont_vm2 = 0
prob_vm2 = []
for i in range(N):
  if Ef_r[i]-vm2_r[i] <= 0:
    cont_vm2 += 1
  prob_vm2.append(cont_vm2/(i+1))
  ###########
cont_vm3 = 0
prob_vm3 = []
for i in range(N):
  if Ef_r[i]-vm3_r[i] <= 0:
    cont_vm3 += 1
  prob_vm3.append(cont_vm3/(i+1))
  ###########
cont_vm4 = 0
prob_vm4 = []
for i in range(N):
  if Ef_r[i]-vm4_r[i] <= 0:
    cont_vm4 += 1
  prob_vm4.append(cont_vm4/(i+1))
  ###########
cont_vm5 = 0
prob_vm5 = []
for i in range(N):
  if Ef_r[i]-vm5_r[i] <= 0:
    cont_vm5 += 1
  prob_vm5.append(cont_vm5/(i+1))
  ###########
cont_vmN = 0
prob_vmN = []
for i in range(N):
  if Ef_r[i]-vmN_r[i] <= 0:
    cont_vmN += 1
  prob_vmN.append(cont_vmN/(i+1))
  ###########
graph_names = ['Año 1','Año 2','Año 3','Año 4','Año 5','Nuevo']
y_g = [Ef_r,Ef_r,Ef_r,Ef_r,Ef_r,Ef_r]
x_g =[vm1_r,vm2_r,vm3_r,vm4_r,vm5_r,vmN_r]
max_g = [max(vm1_r),max(vm2_r),max(vm3_r),max(vm4_r),max(vm5_r),max(vmN_r)]
fig1 = plt.figure("Funciones de estado limite", figsize=(15,15))
fig1.subplots_adjust(hspace=0.3, wspace=0.3)
for i in range(1,len(x_g)+1):
  ax = fig1.add_subplot(3, 3, i)
  x_min, y_min, x_max, y_max = 0, 0, max_g[i-1], max_g[i-1]
  ax.set(xlim=(x_min,x_max),ylim=(y_min,y_max))
  ax.set(xlim=(x_min,x_max),ylim=(y_min,y_max))
  sns.scatterplot(x=x_g[i-1],y=y_g[i-1])
  x_max = y_max
  ax.plot([x_min,x_max],[y_min,y_max],'r')
  ax.
 ↪fill_between(x=[x_min,x_max],y1=[y_min,y_max],y2=[y_max,y_max],color="#d7e8d5",zorder=0)
```

```
  ax.
 ↪fill_between(x=[x_min,x_max],y1=[y_min,y_max],y2=[y_min,y_min],color="#fae4e4",zorder=0)
  plt.xlabel('Desafio [MPa]')
  plt.ylabel('Capacidad [Mpa]')
  plt.title(graph_names[i-1])
  ax.grid(color='gray', linestyle='dashed', linewidth=1, alpha=0.4)
```



```
[15]: graph_names = ['Año 1','Año 2','Año 3','Año 4','Año 5','Nuevo']
      prob_g = [prob_vm1,prob_vm2,prob_vm3,prob_vm4,prob_vm5,prob_vmN]
      probs_f␣
       ↪=[prob_vm1[-1],prob_vm2[-1],prob_vm3[-1],prob_vm4[-1],prob_vm5[-1],prob_vmN[-1]]
      fig2 = plt.figure("Probabilidades", figsize=(10,10))
      fig2.subplots_adjust(hspace=0.6, wspace=0.4)
      for i in range(1,len(prob_g)+1):
        ax2 = fig2.add_subplot(3, 3, i)
        ax2.plot(prob_g[i-1],"g--")
        ax2.set_xlabel("Probabilidad: {:.3f}%".format(probs_f[i-1]*100))
        ax2.set_ylabel("Probabilidad de falla")
        ax2.set_title(graph_names[i-1])
        ax2.grid(color='gray', linestyle='dashed', linewidth=1, alpha=0.4)
        ax2.axhline(0, color='black', linewidth=0.5)
```



[ ]:

```
!wget -nc https://raw.githubusercontent.com/brpy/colab-pdf/master/colab_pdf.py
from colab_pdf import colab_pdf
colab_pdf("Simulaciones_Montecarlo.ipynb")
```

```
--2022-06-16 18:59:48--  https://raw.githubusercontent.com/brpy/colab-
pdf/master/colab_pdf.py
Resolving raw.githubusercontent.com (raw.githubusercontent.com)…
185.199.108.133, 185.199.109.133, 185.199.110.133, …
Connecting to raw.githubusercontent.com
(raw.githubusercontent.com)|185.199.108.133|:443… connected.
HTTP request sent, awaiting response… 200 OK
Length: 1864 (1.8K) [text/plain]
Saving to: ‘colab_pdf.py’

colab_pdf.py        100%[===================>]   1.82K  --.-KB/s    in 0s

2022-06-16 18:59:48 (36.7 MB/s) - ‘colab_pdf.py’ saved [1864/1864]


WARNING: apt does not have a stable CLI interface. Use with caution in scripts.


WARNING: apt does not have a stable CLI interface. Use with caution in scripts.
```

```
Extracting templates from packages: 100%
```