Derivada de Caputo usando *Numfracpy*

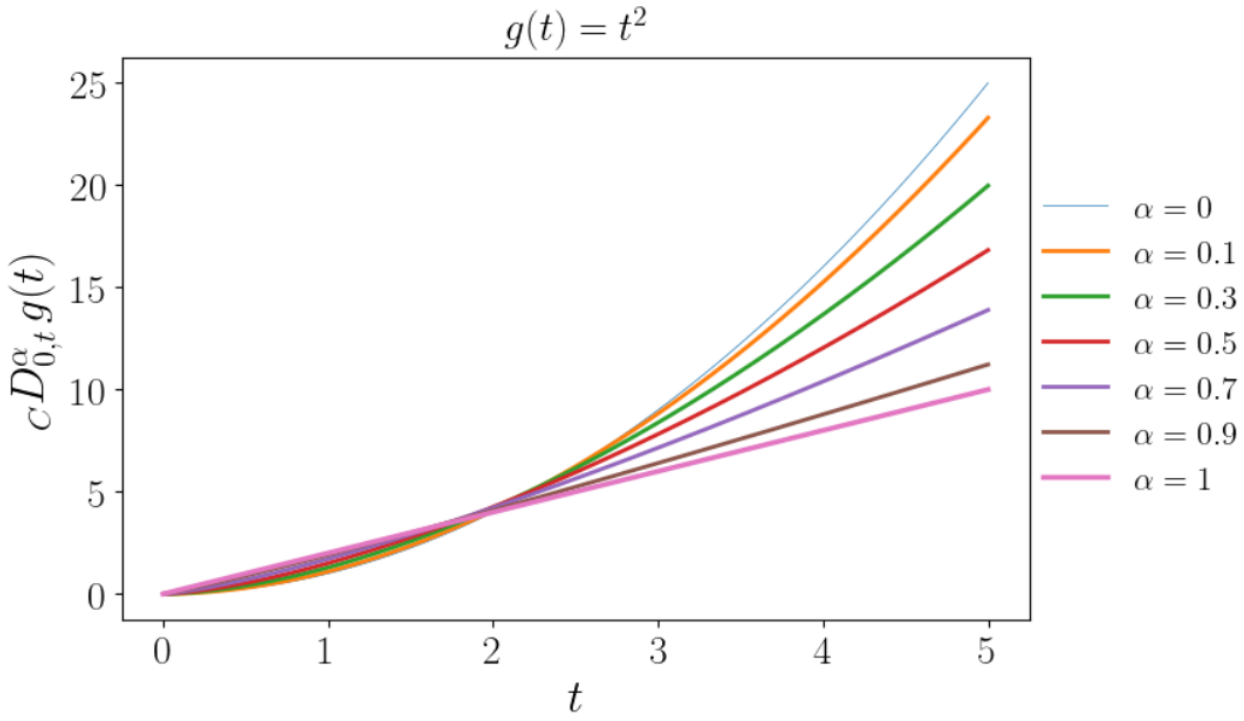
```
!pip install numfracpy
!sudo dpkg --configure -a
!sudo apt install cm-super dvipng texlive-latex-extra texlive-latex-recommended
```

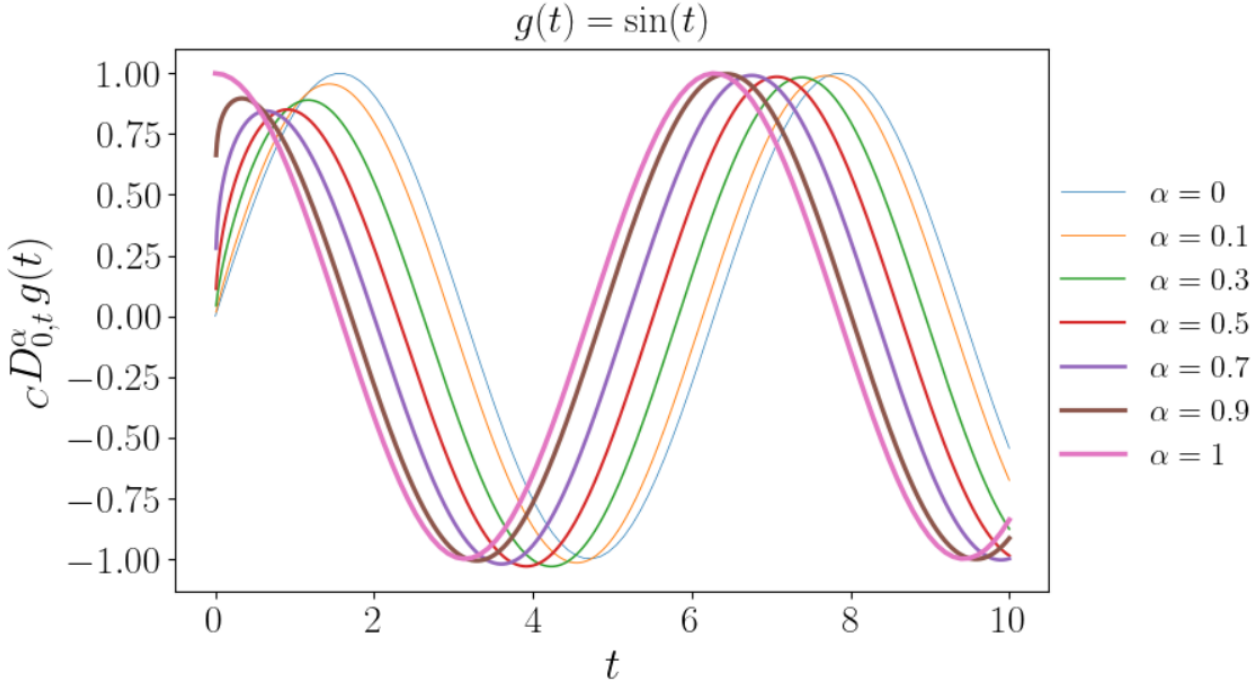
```
import numfracpy as nfr
import matplotlib.pyplot as plt
import numpy as np

plt.rcParams.update({
    'text.usetex': True,
    'font.family': 'serif',
})
%matplotlib inline
```

```
def g(t):
    return t**2
```

```
fig = plt.figure(figsize=(8,5))
plt.title(r'$g(t)=t^2$',y=1.01,size=20)
t_max = 5
for alpha in [0,0.1,0.3,0.5,0.7,0.9,1]:
    if alpha == 0.0:
        T = np.linspace(0,t_max,100)
        f = g(T)
        plt.plot(T,f,label=r'$\alpha='+str(round(alpha,1))+'$',linewidth=0.5+alpha*2)
        continue
    if alpha == 1.0:
        T = np.linspace(0,t_max,100)
        f = 2*T #np.full((len(T)),1)
        plt.plot(T,f,label=r'$\alpha='+str(round(alpha,1))+'$',linewidth=0.5+alpha*2)
        continue
    T=[]
    Df=[]
    t=0.01
    while t<=t_max:
        T.append(t)
        Df.append(nfr.fd_Caputo(g,t,0,alpha,1e-6)[0])
        t+=0.01
    plt.plot(T,Df,label=r'$\alpha='+str(round(alpha,1))+'$',linewidth=2)
plt.legend(loc=(1,0.2),shadow=False,ncol=1,prop={'size':16},frameon=False)
plt.xticks(size=20)
plt.yticks(size=20)
plt.xlabel(r'$t$',size=23)
plt.ylabel(r'${}_C D_{0,t}^\alpha\, g(t)$',size=23)
plt.show()
fig.savefig('Caputo1.png',dpi=100,bbox_inches='tight')
```


$g(t) = t^2$
${}_C D^{\alpha}_{0,t}\, g(t)$
t
$\alpha = 0$
$\alpha = 0.1$
$\alpha = 0.3$
$\alpha = 0.5$
$\alpha = 0.7$
$\alpha = 0.9$
$\alpha = 1$


$g(t) = \sin(t)$
${}_C D^{\alpha}_{0,t}\, g(t)$
t
$\alpha = 0$
$\alpha = 0.1$
$\alpha = 0.3$
$\alpha = 0.5$
$\alpha = 0.7$
$\alpha = 0.9$
$\alpha = 1$

Integral de Riemann-Liouville usando *Numfracpy*