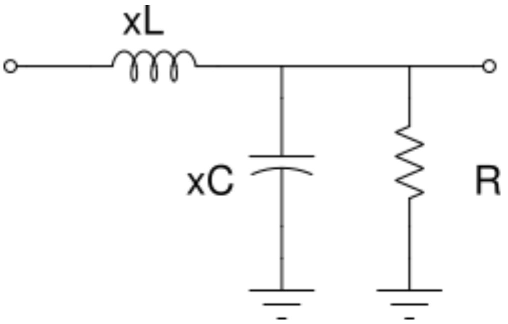
In [1]:
```
import numpy as np
# import sympy as sp
from scipy import signal
from numpy import pi as π
import matplotlib.pyplot as plt
%matplotlib inline
```



Parámeters

$Q = 0.9$

$R = 8\Omega$

$freq = 2kHz$

Canonical equation Low Pass filter 2nd Order

$$H(s) = G \cdot \frac{\omega_0^2}{s^2 + \frac{\omega_0}{Q}s + {\omega_0}^2}$$

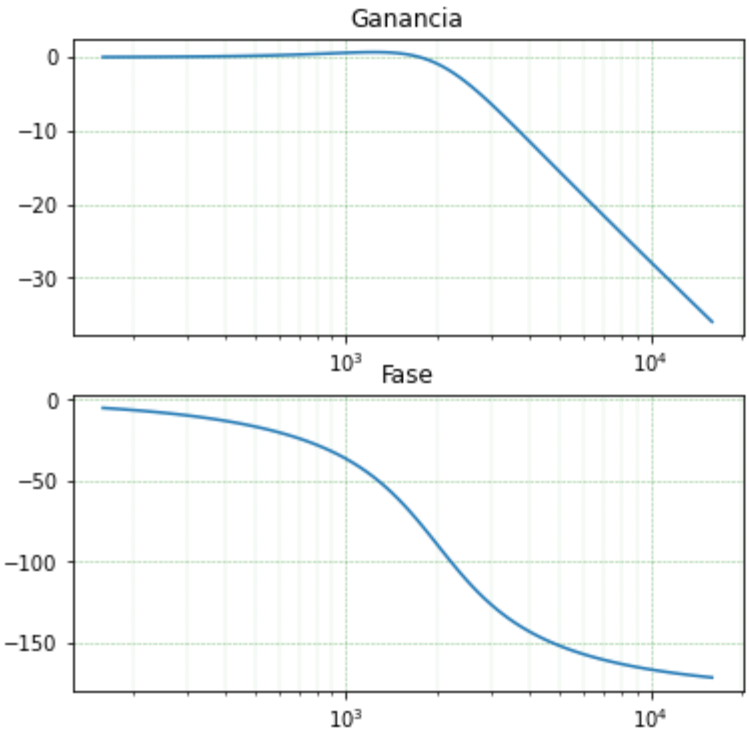
In [2]:
```
ω_0 = 2*π*2000; Q=0.9; G = 1
```

In [3]:
```
num = [ω_0**2]
den = [1, ω_0/Q, ω_0**2]
LP_filter = signal.lti(num,den)
LP_filter
```

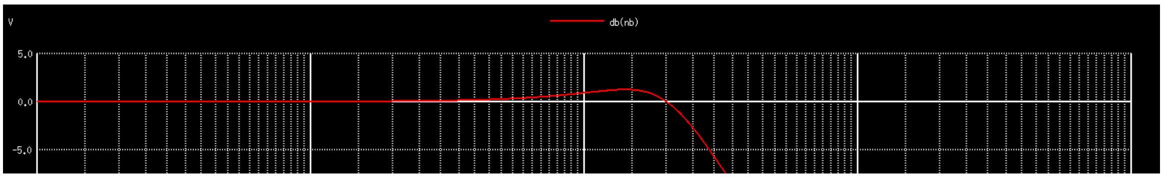
Out[3]:
```
TransferFunctionContinuous(
array([1.5791367e+08]),
array([1.0000000e+00, 1.3962634e+04, 1.5791367e+08]),
dt: None
)
```

In [4]:

```
w, mag, phase = signal.bode(LP_filter)
fig, (ax1,ax2) = plt.subplots(2,1,figsize=(6,6))
ax1.semilogx(w/2/π, mag) # Eje x logaritmo
ax2.semilogx(w/2/π, phase) # Eje x logaritmico

ax1.set_title('Ganancia') #Decoracion
ax2.set_title('Fase') # Decoracion

ax1.grid(color='g', linestyle='--', linewidth=0.5, alpha=0.5,which='major'
ax1.grid(color='g', linestyle='--', linewidth=0.2, alpha=0.5,which='minor'

ax2.grid(color='g', linestyle='--', linewidth=0.5, alpha=0.5,which='major'
ax2.grid(color='g', linestyle='--', linewidth=0.2, alpha=0.5,which='minor'
```



ngspice response S-Parameter simulation



Find "ideal" Componets

$Q = \omega_0 CR$

$\omega_0 = \frac{1}{\sqrt{LC}}$

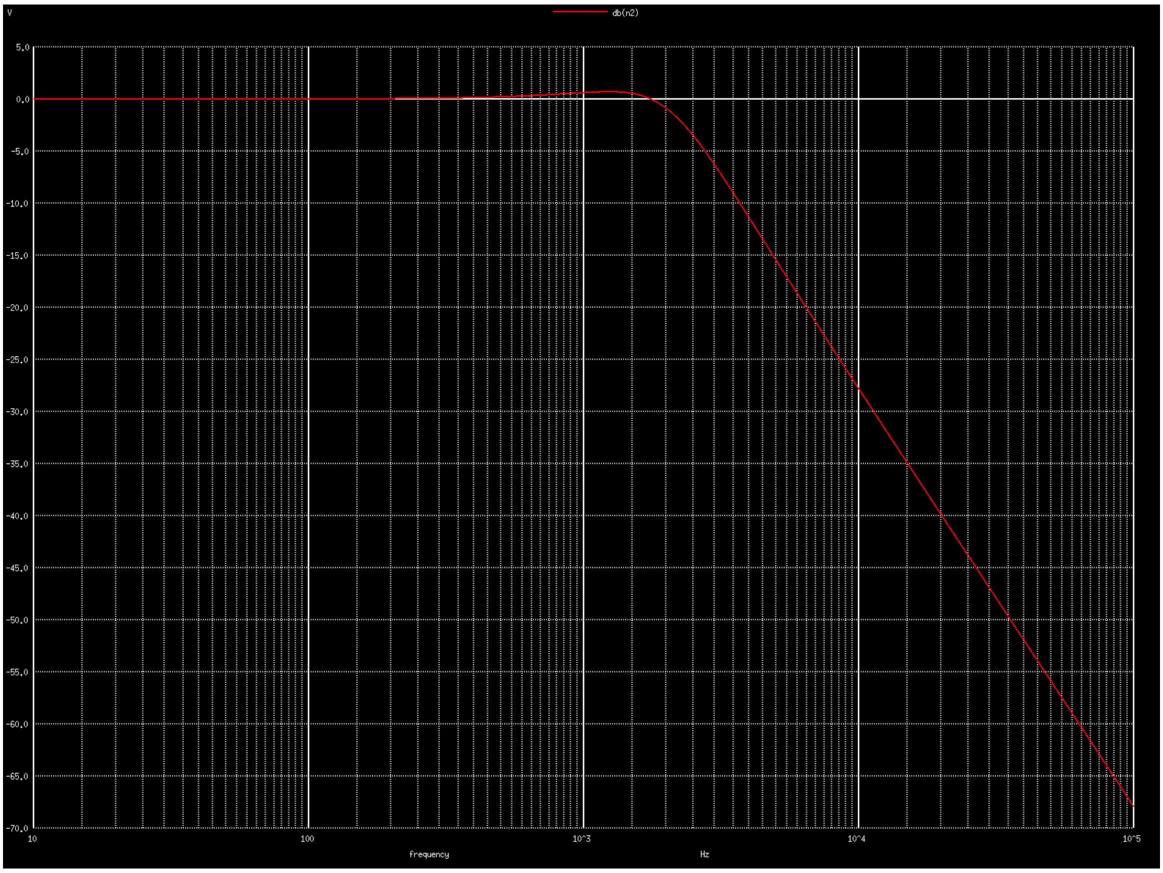
In [5]:
```
R = 8; Q = 0.9;
C = Q/ω_0/R
C
```

Out[5]: 8.952465548919114e-06

In [6]:
```
L=1/ω_0**2/C
L
```

Out[6]: 0.0007073553026306459

ngspice response "ideal" components simulation



In [ ]: