This is a short program to solve our Damped Driven Pendulum. From the book the equation we want to solve is

$$\phi'' + 2\beta\phi' + \omega_0^2 \sin\phi = \omega_0^2 \cos\omega t$$

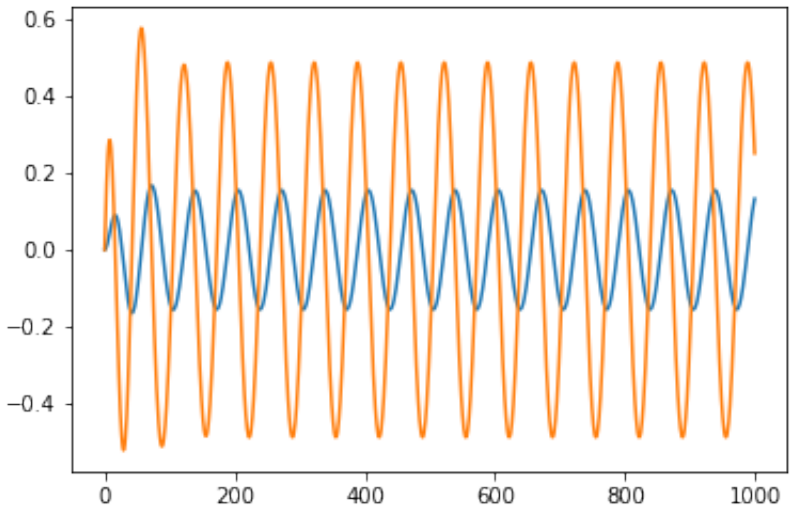
To solve this in python we will convert this single second order differential equation into two coupled first order differential equations. We can do this with the substitutions of $x_0 = \phi$ and $x_1 = \phi'$. This leads to the two equations

$$x_0' = x_1$$

and

$$x_1' = -2\beta x1 - \omega_0^2 \sin x_0 + \gamma\omega_0^2 \cos\omega t$$

In [23]:
```
import math
import numpy as np
from scipy import integrate
import matplotlib.pyplot as plt

omega=math.pi
omega0=1.5*omega
beta=omega0/4.0
gamma = 0.1

def eqns(x,t):
    x0=x[0]
    x1=x[1]
    dxdt1=-2*beta*x1 -omega0**2 * math.sin(x0) +gamma * omega0**2 * ma
    return [x1,dxdt1]

x0=[0.0,0.0]
t = np.linspace(0,30,1000)

s=integrate.odeint(eqns,x0,t)

plt.plot(s)
plt.show()
```



In [ ]:
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