**Example of a second order circuit response**

Consider the following function transfer function of a 2nd order (RLC) low-pass filter.

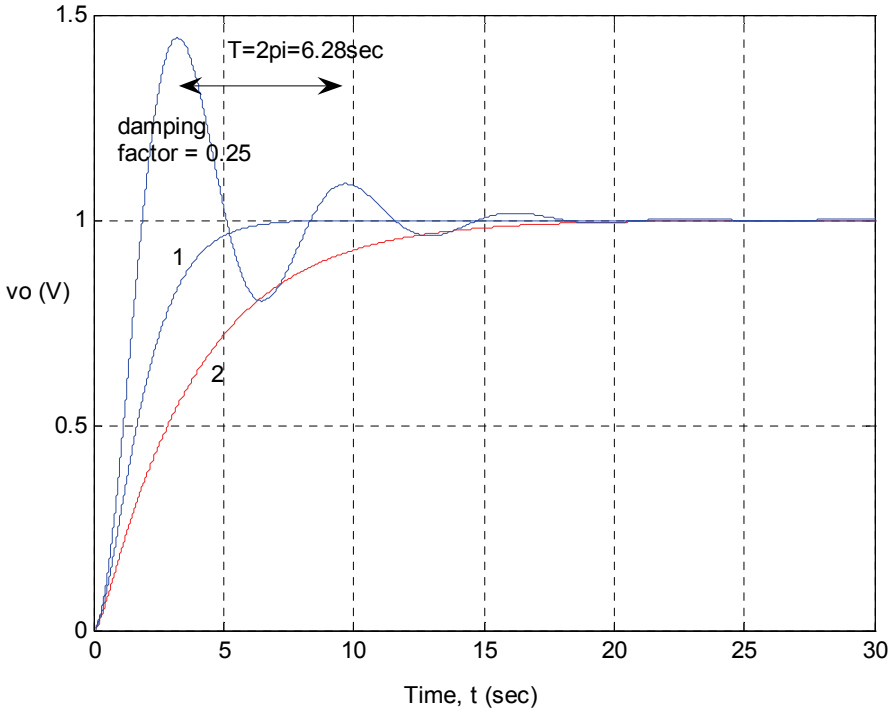
$$\frac{V_o(s)}{V_i(s()} = \frac{1}{(s^2 + 2\zeta s + 1)}$$

in which the undamped natural frequency $\omega_o$=1 rad/s

For a unit step function as the input (Vi(s)=1/s), the output can be written as,

$$V_o(s) = \frac{1}{s(s^2 + 2\zeta s + 1)}$$

The following plot shows the time response of the output for a unit step input, for the case of ζ=0.25 (under-damped), ζ=1 (critically damped) and ζ=2 (over-damped).




The expressions of the output are equal to:

a) vo=1+1.03*exp(-0.25*t).*cos(0.97*t+165.54$^o$) (case ζ=0.25)

b) vo=1+0.077*exp(-3.732*t)-1.077*exp(-0.268*t) (case ζ=2)

c) v0=1-t.*exp(-t)-exp(-t) (case ζ=1)