We can write $A\cos\omega t + B\sin\omega t$

as $C\cos(\omega t - \alpha)$

where $C = \sqrt{A^2 + B^2}$ $\qquad \tan\alpha = \frac{B}{A}$

Most important is C = amplitude

$$C^2 = A^2 + B^2 = \frac{(k-m\omega^2)^2 F_0^2 + (c\omega)^2 F_0^2}{\left((k-m\omega^2)^2 + (c\omega)^2\right)^2}$$

$$= \frac{F_0^2}{(k-m\omega^2)^2 + (c\omega)^2}$$

$$C = \text{Amplitude} = \frac{F_0}{\sqrt{(k-m\omega^2)^2 + (c\omega)^2}}$$

When the damping c is not zero, the denominator is <u>always</u> positive.

$$c \neq 0 \Rightarrow (c\omega)^2 > 0 \Rightarrow (k-m\omega^2)^2 + (c\omega)^2 > 0$$

So strictly speaking, there is no "resonance" in the damped system.

But we can still plot C vs. ω

if ω very small, $C \approx \frac{F_0}{k}$

if ω very large $C \approx 0$