

# Summary: Vibrations - Forced Response 1

EOM: For forced response:

$$M\ddot{x} + C\dot{x} + Kx = F_0 \sin \Omega t \Rightarrow \ddot{x} + 2\zeta\omega_n \dot{x} + \omega_n^2 x = \frac{F_0}{M} \sin \Omega t$$

TOTAL RESPONSE: Since this is a linear EOM, we can write:

$$x(t) = x_C(t) + x_P(t)$$

where  $x_C(t) = e^{-\zeta\omega_n t} (C \cos \omega_d t + S \sin \omega_d t)$

HOW TO FIND PARTICULAR SOLUTION?

$$x_P(t) = A \sin \Omega t + B \cos \Omega t$$

Substitute into EOM and solve for  $A$  and  $B$ . If the system is undamped, then you will find that  $B = 0$ .

ENFORCING IC's: The initial conditions are enforced on the TOTAL solution  $x(t)$ , NOT on the complementary solution  $x_C(t)$ !