Forced Oscillation

Reading: Section 15.

The driving force is harmonic:

$$F_e(t) = F_0 \cos(\omega_d t)$$

ω_d is the angular frequency of the driving force.

Using Newton II ($F = ma$) we can form a differential equation for a force harmonic motion:

$$m\frac{d^2x}{dt^2} + b\frac{dt}{dt} + kx = F_0 \cos(\omega_d t)$$

The steady state solution:

$$x(t) = x_m \cos(\omega_d t + \phi)$$

where

$$x_m = \frac{F_0}{\sqrt{m^2(\omega_d^2 - \omega^2)^2 + b^2\omega_d^2}}$$

So, to find x_m we calculate the maximum of ω^2:

$$\omega_{max}^2 = \omega - \frac{1}{2}\frac{b^2}{m^2}$$