Answer on Question #41433, Physics, Mechanics | Kinematics | Dynamics

A forced oscillation for which the frequency of the external periodic impulse that drives it is equal to the natural frequency of the oscillation is refered to as

resonance

damped oscillation

coupled oscillation

quality factor

Solution:

The damped harmonic oscillator equation of motion is: $x'' + \gamma x' + x\omega_0^2 = 0$, where $\gamma = b/m$ is related to the velocity-proportional damping force and $\omega_0^2 = k/m$ is the natural frequency of the system.

When driven by an external force at an angular frequency ω, $F_0\cos(\omega t)$ the equation of motion is:

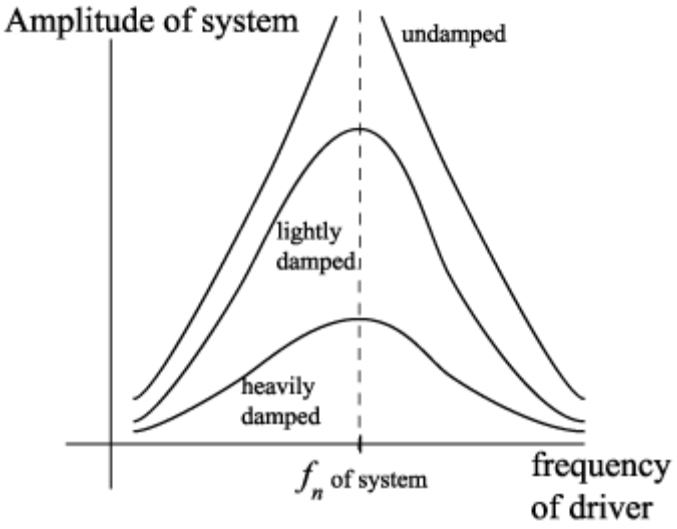
$$x'' + \gamma x' + \omega_0^2 = \frac{F_0}{m}\cos(\omega t)$$

After several time constants ($t >> 2/\gamma$) the motion is described by the steady-state solution:

$$x(t) = A(\omega)\cos(\omega t + \Phi)$$

where $A(\omega) = \frac{F_0}{m}\frac{1}{\left[\left(\omega_0^2 - \omega^2\right)^2 + (\omega\gamma)^2\right]^{\frac{1}{2}}}$ and $\Phi = \arctan\left(\frac{\gamma\omega}{\omega_0^2 - \omega^2}\right)$.

Resonance is the phenomenon that occurs when the frequency of forced vibrations on an object matches the natural frequency of that object, and produces a dramatic increase in amplitude.



Answer. resonance.