Amplitude and Phase: Second Order I Applet

You should open the applet `Amplitude and Phase: Second Order I`
This applet works exactly like the applet `Amplitude and Phase: Second Order II` shown in the previous video.

The applet illustrates the spring-mass-dashpot system being driven through the spring, which we studied earlier in the session. The mass $m = 1$ and the DE describing this system is

$$\ddot{x} + b\dot{x} + kx = k\cos(\omega t),$$

where we consider $\cos(\omega t)$ to be the input.

Unlike `Amplitude and Phase: Second Order II`, the resonant frequency and maximum gain changes as b and k are changed.

You should play with the applet. Check the box for the Bode plots. Now set $b = .7$ and play with the control for k. While you do this pay attention to what is happening in the amplitude response plot (the upper Bode plot).

Pick simple values of b and k and verify that there is practical resonance when $b < \sqrt{2k}$. In these cases, verify the amplitude response reaches its peak at the practical resonant frequency $\omega_r = \sqrt{k - b^2/2}$.

Verify that the practical resonant frequency is to the left of the natural frequency $\omega_0 = \sqrt{k/m}$ (remember $m = 1$). Notice that as b decreases towards 0 the resonant frequency increases towards ω_0.

18.03SC Differential Equations
Fall 2011