[mex181] Driven harmonic oscillator: kinetic and potential energy

Consider the driven harmonic oscillator, $m\ddot{x} = -kx - \gamma\dot{x} + F_0\cos\omega t$, in a steady-state motion. (a) Calculate the average kinetic energy $\langle T(\omega)\rangle$, the average potential energy $\langle V(\omega)\rangle$, and the average total energy $\langle E(\omega)\rangle = \langle T(\omega)\rangle + \langle V(\omega)\rangle$. Use the parameters $\beta \doteq \gamma/2m$, $\omega_0 \doteq \sqrt{k/m}$, $A \doteq F_0/m$.. (b) Each quantity assumes its maximum value at a different resonant frequency: $\omega_T, \omega_V, \omega_E$. Determine each resonant frequency.

Solution: