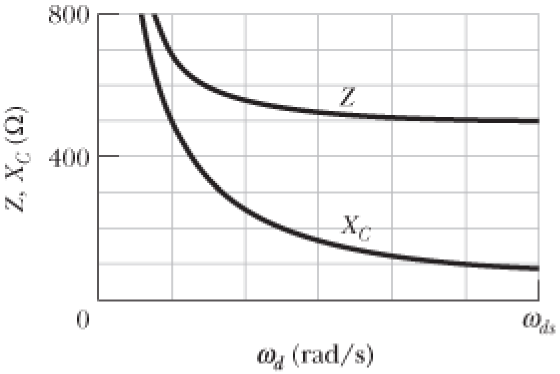
# Home Work 11

11-1 Using the loop rule, derive the differential equation for an $LC$ circuit:

$$L\frac{d^2q}{dt^2}+\frac{1}{C}q=0$$

11-2 A series circuit containing inductance $L_1$ and capacitance $C_1$ oscillates at angular frequency $\omega$. A second series circuit, containing inductance $L_2$ and capacitance $C_2$, oscillates at the same angular frequency. In terms of $\omega$, what is the angular frequency of oscillation of a series circuit containing all four of these elements? Neglect resistance. (*Hint:* Use the formulas for equivalent capacitance and equivalent inductance; see Section 25-4 and Problem 47 in Chapter 30.)

11-3 An alternating source with a variable frequency, a capacitor with capacitance $C$, and a resistor with resistance $R$ are connected in series. The following figure gives the impedance $Z$ of the circuit versus the driving angular frequency $\omega_d$; the curve reaches an asymptote of 500 $\Omega$, and the horizontal scale is set by $\omega_{ds}$ = 300 rad/s. The figure also gives the reactance $X_C$ for the capacitor versus $\omega_d$. What are (a) $R$ and (b) $C$?




11-4 An alternating source with a variable frequency, an inductor with inductance $L$, and a resistor with resistance $R$ are connected in series. The following figure gives the impedance $Z$ of the circuit versus the driving angular frequency $\omega_d$, with the horizontal axis scale set by $\omega_{ds}$ = 1600 rad/s. The figure also gives the reactance $X_L$ for the inductor versus $\omega_d$. What are (a) $R$ and (b) $L$?