Taking $e = E_0 \sin \omega t$, and differentiating the equation,

$$L\frac{d^2i}{dt^2} + R\frac{di}{dt} + \frac{i}{C} = E_0\,\omega \cos \omega t$$

The solution (neglecting terms representing the transients, which die out very quickly after the current is started) is

$$i = \frac{E_0}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}} \sin(\omega t - \theta)$$

The phase angle θ is given by

$$\tan \theta = \frac{\omega L}{R} - \frac{1}{R\omega C} \tag{19}$$

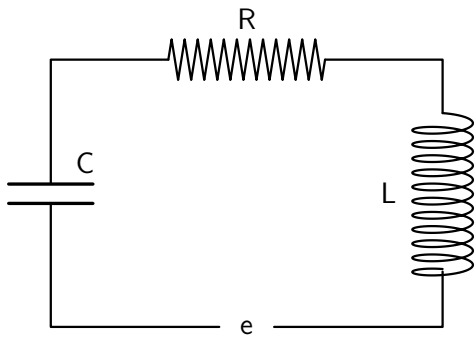


FIG. 10.—*Circuit with resistance, inductance, and capacity in series; a typical radio circuit*

The maximum value of the current is

$$I_0 = \frac{E_0}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}}$$

The impedance is

$$\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}.$$

The relation between effective current and emf is

$$I = \frac{E}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}} \tag{20}$$