The amplitude-modulated signal can be determined from (12.1.1) as follows:

$$C_{AM}(t) = 1000 \cdot [1 + 0.15\{3\cos\omega_1 t) + 2\cos(2\omega_1 t) + \cos(3\omega_1 t)\}]\cos(\omega_c t)\text{V}$$

or,

$$\begin{aligned} C_{AM}(t) = {} & 1000 \cdot \cos(\omega_c t) + 225 \cdot [\cos(\omega_c + \omega_1)t + \cos(\omega_c - \omega_1)t] \\ & + 150 \cdot [\cos(\omega_c + 2\omega_1)t + \cos(\omega_c - 2\omega_1)t] \\ & + 75 \cdot [\cos(\omega_c + 3\omega_1)t + \cos(\omega_c - 3\omega_1)t]\text{V} \end{aligned}$$

where $\omega_1 = 4\pi \times 10^6$ rad/s and $\omega_c = 2\pi \times 10^8$ rad/s.

(a) From the above expression, results can be summarized as follows:

	Carrier	$\omega_c \pm \omega_1$	$\omega_c \pm 2\omega_1$	$\omega_c \pm 3\omega_1$
Frequency	100 MHz	(100 ± 2) MHz	(100 ± 4) MHz	(100 ± 6) MHz
Amplitude	1000 V	225 V	150 V	75 V
Power	10000 W	1012.5 W	450 W	112.5 W

(b) Peak amplitude, $A = 1000 + 2 \times (255) + 2 \times (150) + 2 \times (75) = 1900$ V; peak power $= \alpha A^2 = 36100$ W.

Frequency Converters

Frequency converters use nonlinear electronic devices that multiply the input signals. They can be used to generate high-frequency sinusoidal signals from a low-frequency reference. Consider the frequency converter shown in Figure 12.5. Let V_i and V_L be two sinusoidal inputs that produce V_o at its output.

Mathematically,

$$V_i = a\cos(\omega_1 t)$$

$$V_L = b\cos(\omega_2 t)$$

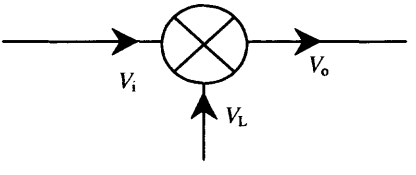

Figure 12.5 A frequency converter.