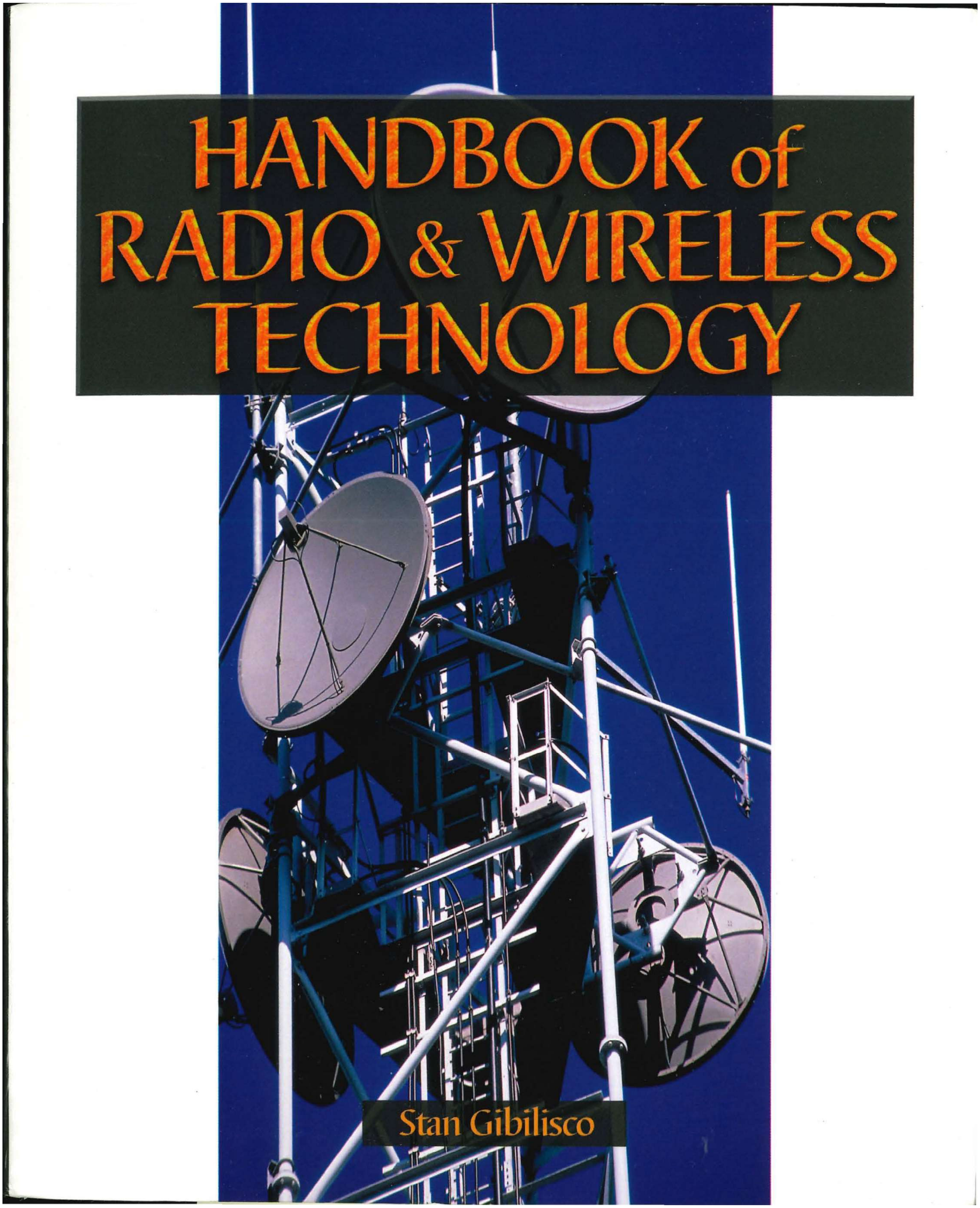

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will radiate. Parasitic arrays, such as the Yagi antenna and the quad antenna, operate on this principle.

Selective Filters

The term *selective filter* refers to circuits designed to tailor the way an electronic circuit or system responds to signals at various frequencies. There are many kinds of selective filters. Some are used at AF; others are used at RF.

Bandpass Filter

Any resonant circuit, or combination of resonant circuits, designed to discriminate against all frequencies except a specific frequency f_0, or a band of frequencies between two limiting frequencies f_0 and f_1, is called a *bandpass filter.* In a parallel LC circuit, a bandpass filter shows a high impedance at the desired frequency or frequencies, and a low impedance at unwanted frequencies. In a series LC configuration, the filter has a low impedance at the desired frequency or frequencies, and a high impedance at unwanted frequencies. Figure 2-9A shows a simple parallel-tuned LC bandpass filter; Fig. 2-9B shows a simple series-tuned LC bandpass filter.

Some bandpass filters are built with components other than actual coils and capacitors, but all such filters operate on the same principle. The *crystal filter* uses piezoelectric materials, usually quartz, to obtain a bandpass response. A *mechanical filter* uses vibration resonances of certain substances, usually ceramics. In optics, a simple color filter, discriminating against all light wavelengths except within a certain range, is a form of bandpass filter.

Bandpass filters are sometimes designed to have very sharp, defined, resonant frequencies. Sometimes the resonance is spread out over a fairly wide range. The *attenuation-versus-frequency characteristic* of a bandpass filter is called the *bandpass response.* A bandpass filter can have a single, well-defined resonant frequency f_0, as shown in Fig. 2-9C, or the response might be more or less rectangular, having two well-defined limit frequencies f_0 and f_1, as shown at D. The bandwidth might be only a few hertz, such as with an audio filter designed for reception of Morse code. Or the bandwidth might be several megahertz, as in a helical filter

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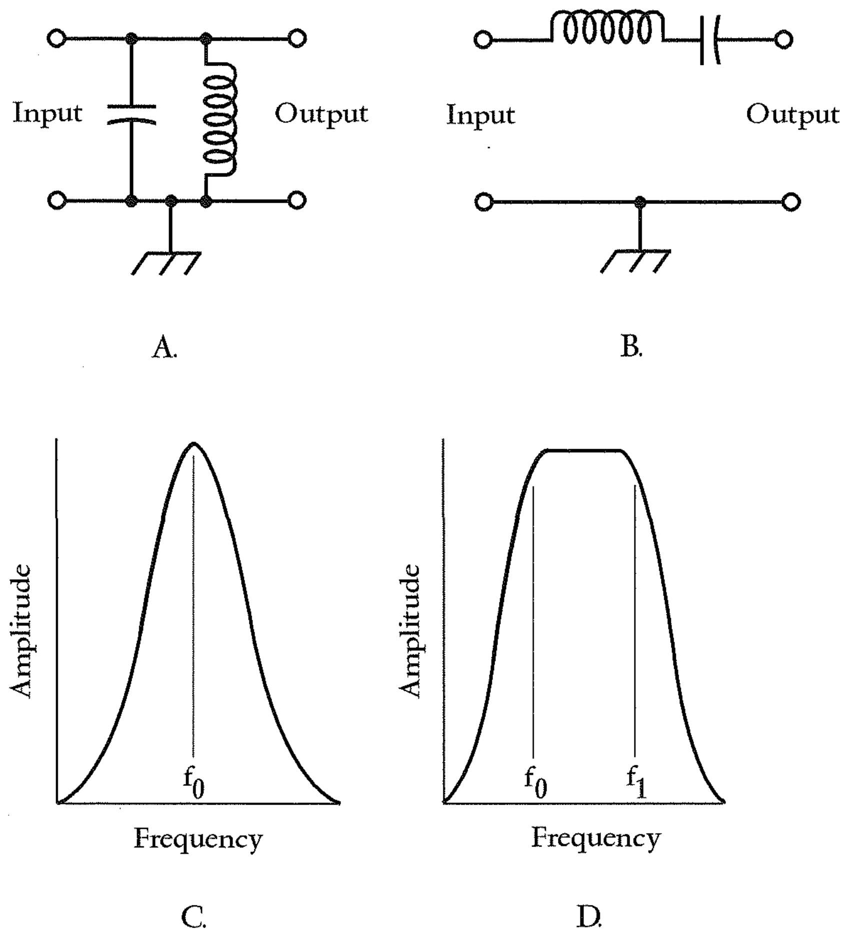

Figure 2-9
At A, elementary parallel-resonant bandpass filter. At B, elementary series-resonant bandpass filter. At C, sharp bandpass response. At D, broad bandpass response.

designed for the front end of a VHF or UHF radio receiver. A bandpass response is always characterized by high attenuation at all frequencies except within a particular range. The actual attenuation at desired frequencies is called the *insertion loss*.

Band-Rejection Filter

A *band-rejection filter*, also called a *band-stop filter*, is a resonant circuit designed to pass energy at all frequencies, except within a certain range. The attenuation is greatest at the resonant frequency f_0, or between two limiting frequencies f_0 and f_1. Figure 2-9E shows a simple parallel-resonant LC band-rejection filter; drawing F shows a simple series-resonant LC band-rejection filter. Note the similarity between band-rejection and bandpass filters. The fundamental difference is that

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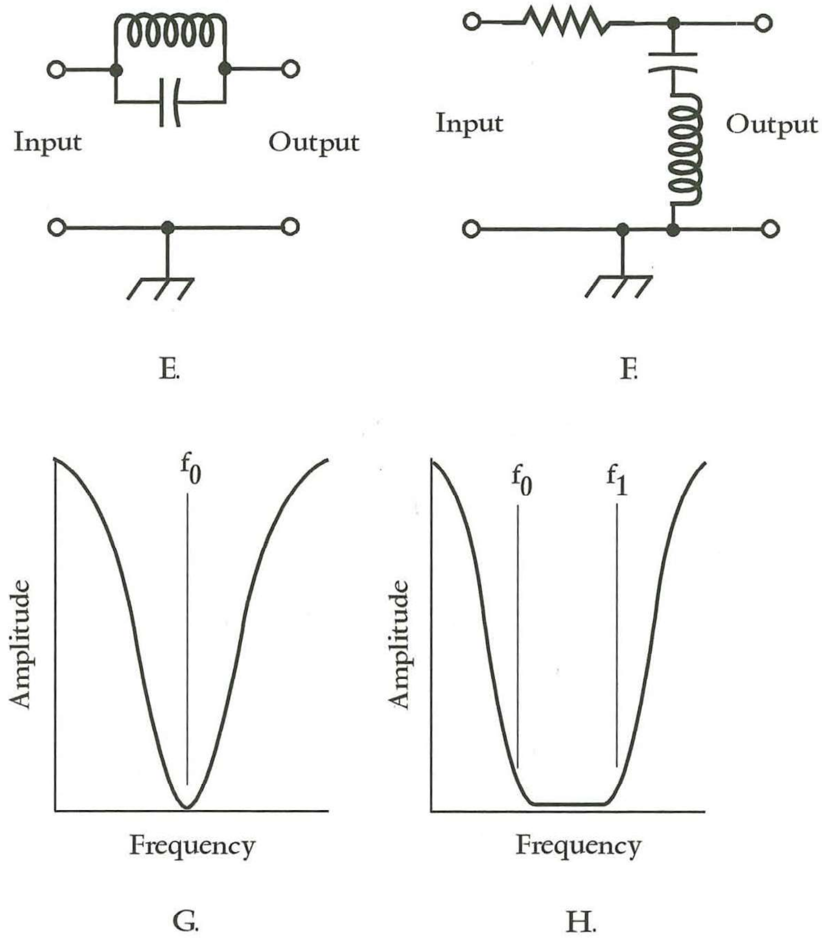

Figure 2-9 (cont.) At E, elementary parallel-resonant band-rejection filter. At F, elementary series-resonant band-rejection filter. At G, sharp band-rejection response. At H, broad band-rejection response.

the band-rejection filter consists of parallel LC circuits connected in series with the signal path, or series LC circuits in parallel with the signal path; in bandpass filters, series-resonant circuits are connected in series, and parallel-resonance circuits in parallel.

Band-rejection filters need not necessarily be made up of coils and capacitors, but they often are. Quartz crystals are sometimes used as band-rejection filters. Lengths of transmission line, either short-circuited or open, are useful as band-rejection filters at the higher radio frequencies. A common example of a band-rejection filter is a *parasitic suppressor,* used in high-power RF amplifiers.

All band-rejection filters show an attenuation-versus-frequency characteristic marked by low loss at all frequencies except within a prescribed range. Figure 2-9G and H shows two types of band-rejection response. A sharp response (at G) occurs at or near a single resonant frequency f_0. A

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