

10.3 CORRELATION DETECTION¹⁴⁻²³

Equation (10.18) describes the output of the matched filter as the cross correlation between the input signal and a delayed replica of the transmitted signal. This implies that the matched-filter receiver can be replaced by a cross-correlation receiver that performs the same mathematical operation, as shown in Fig. 10.3. The input signal $y(t)$ is multiplied by a delayed replica of the transmitted signal $s(t - T_r)$, and the product is passed through a low-pass filter to perform the integration. The cross-correlation receiver of Fig. 10.3 tests for the presence of a target at only a single time delay T_r . Targets at other time delays, or ranges, might be found by varying T_r . However, this requires a longer search time. The search time can be reduced by adding

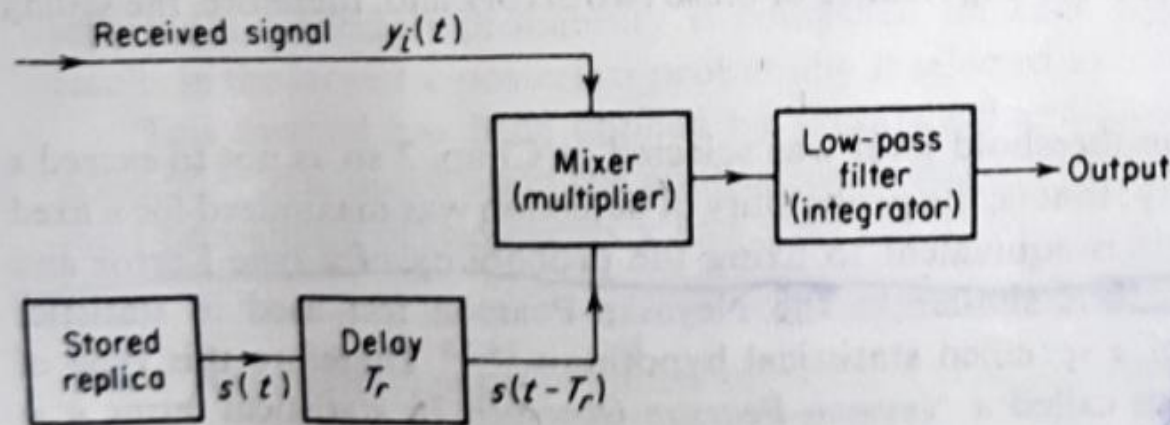


Figure 10.3 Block diagram of a cross-correlation receiver.

parallel channels, each containing a delay line corresponding to a particular value of T_r , as well as a multiplier and low-pass filter. In some applications it may be possible to record the signal on some storage medium, and at a higher playback speed perform the search sequentially with different values of T_r . That is, the playback speed is increased in proportion to the number of time-delay intervals T_r that are to be tested.

Since the cross-correlation receiver and the matched-filter receiver are equivalent mathematically, the choice as to which one to use in a particular radar application is determined by which is more practical to implement. The matched-filter receiver, or an approximation, has been generally preferred in the vast majority of applications.