INTRODUCTION TO RADAR SYSTEMS

UNIT-IV

Lecture-5

Detector Characteristics

- The portion of the radar receiver which extracts the modulation from the carrier is called the detector.
- The use of this term implies somewhat more than simply a rectifying element. It includes that portion of the radar receiver from the output of the IF amplifier to the input of the indicator or data processor.
- We shall not be concerned about the problem of amplification, although it is an important aspect of receiver design.

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- Instead, we shall be more interested in the effect of the detector on the desired signal and the noise.
- One form of detector is the envelope detector, which recognizes the presence of the signal on the basis of the amplitude of the carrier envelope. All phase information is destroyed. It is also possible to design a detector which utilizes only phase information for recognizing targets. An example is one which counts the zero crossings of the received waveform.

Contd.

- The zero-crossings detector destroys amplitude information.
- If the exact phase of the echo carrier were known, it would be possible to design a detector which makes optimum use of both the phase information and the amplitude information contained in the echo signal.
- It would perform more efficiently than a detector which used either amplitude information only or phase information only.

Envelope Detector—Optimum-detector Law.

- The coherent detector is an example of one which uses both phase and amplitude. These three types of detectors—the envelope, the zero-crossings, and the coherent detectors—are considered in the present section.
- The function of the envelope detector is to extract the modulation and reject the carrier.
- By eliminating the carrier, all phase information is lost and the detection decision is based solely on the envelope amplitude.

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- The envelope detector consists of a rectifying element and a low-pass filter to pass the modulation frequencies but to remove the carrier frequency.
- The rectifier characteristic relates the output signal to the input signal and is called the detector law.
- Most detector laws approximate either a linear or a square-law characteristic. In the linear detector the output signal is directly proportional to the input envelope.

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- Similarly, in the square-law detector, the output signal is proportional to the square of the input envelope.
- In some of the quoted mathematical results, the linear-detector law is assumed, while in others, the square law is assumed.
- In general, the difference between the two is small and the detector law in any analysis is usually chosen for mathematical convenience.

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- When we speak of a detector law we really mean the combined law of the detector and video integrator, if one is used.
- If the detector were linear while the video integrator had a square-law characteristic, the combination of detector and integrator would be considered square law.
- The greater the likelihood ratio, the more probable it is that the receiver input is due to signal-plus-noise rather than noise alone.