INTRODUCTION TO RADAR SYSTEMS

UNIT–III

Lecture–8

Angle Fluctuations

- Changes in the target aspect with respect to the radar can cause the apparent center of radar reflections to wander from one point to another. (apparent center of radar reflection is the direction of the antenna when the error signal is zero.)
- In general, the apparent center of reflection might not correspond to the target center. In fact, it need not be confined to the physical extent of the target and may be off the target a significant fraction of the time.

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- The random wandering of the apparent radar reflecting center gives rise to noisy or jittered angle tracking. This form of tracking noise is called angle noise, angle scintillations, angle fluctuations, or target glint.
- The angular fluctuations produced by small targets at long range may be of little consequence in most instances.

Contd.

- However, at short range or with relatively large targets, angular fluctuations may be the chief factor limiting tracking accuracy.
- Angle fluctuations affect all tracking radars whether conical-scan, sequential-lobing, or mono pulse.
- Angle fluctuations are due to random changes in the relative distance from radar to the scatterers, that is, varying values of x.

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- Consider a rather simplified model of a complex radar target consisting of two independent isotropic scatterers separated by an angular distance dD, as measured from the radar.
- It is also a close approximation to the low-angle tracking problem in which the radar sees the target plus its image reflected from the surface.

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- Although such a target may be fictitious and used for reasons of mathematical simplicity, it might approximate a target such as a small fighter aircraft with wing-tip tanks or two aircraft targets flying in formation and located within the same radar resolution cell.
- The qualitative effects of target glint may be assessed from this model.

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- These changes may result from turbulence in the aircraft flight path or from the changing aspect caused by target motion.
- In essence, angle fluctuations are a distortion of the phase front of the echo signal reflected from a complex target and may be visualized as the apparent tilt of this phase front as it arrives at the tracking system.

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- A slightly more complex model than the two-scatterer target considered above is one consisting of many individual scatterers, each of the same cross section, arranged uniformly along a line of length L perpendicular to the line of sight from the radar.
- The resultant cross section from such a target is assumed to behave according to the Rayleigh probability distribution. The probability of the apparent radar center lying outside the angular region of LjR radians (in one tracking plane) is 0. 1 34, where R is the distance to the target.

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- Thus 13.4 per cent of the time the radar will not be directed to a point on the target.
- Similar results for a two-dimensional model consisting of equal-cross-section scatterers uniformly spaced over a circular area indicate that the probability that the apparent radar center lies outside this target is 0.20.
- Angle fluctuations in a tracking radar are reduced by increasing the time constant of the AGC system (reducing the bandwidth).