

ANTENNA ARRAYS

Antennas with a given radiation pattern may be arranged in a pattern line, circle, plane, etc.) to yield a different radiation pattern.

Antenna array - a configuration of multiple antennas (elements) arranged to achieve a given radiation pattern.

Simple antennas can be combined to achieve desired directional effects. Individual antennas are called elements and the combination is an array

Types of Arrays

1. Linear array - antenna elements arranged along a straight line.
2. Circular array - antenna elements arranged around a circular ring.
3. Planar array - antenna elements arranged over some planar surface (example - rectangular array).
4. Conformal array - antenna elements arranged to conform to some non-planar surface (such as an aircraft skin).

Design Principles of Arrays

There are several array design variables which can be changed to achieve the overall array pattern design. Array Design Variables

1. General array shape (linear, circular, planar)
2. Element spacing.
3. Element excitation amplitude.
4. Element excitation phase.
5. Patterns of array elements.

Types of Arrays:

- Broadside: maximum radiation at right angles to main axis of antenna
- End-fire: maximum radiation along the main axis of antenna
- Phased: all elements connected to source
- Parasitic: some elements not connected to source: They re-radiate power from other elements.

Yagi-Uda Array

- Often called Yagi array
- Parasitic, end-fire, unidirectional
- One driven element: dipole or folded dipole
- One reflector behind driven element and slightly longer
- One or more directors in front of driven element and slightly shorter

Log-Periodic Dipole Array

- Multiple driven elements (dipoles) of varying lengths
- Phased array
- Unidirectional end-fire
- Noted for wide bandwidth
- Often used for TV antennas

Monopole Array

- Vertical monopoles can be combined to achieve a variety of horizontal patterns
- Patterns can be changed by adjusting amplitude and phase of signal applied to each element
- Not necessary to move elements
 - Useful for AM broadcasting

Collinear Array

- All elements along same axis
- Used to provide an omnidirectional horizontal pattern from a vertical antenna
- Concentrates radiation in horizontal plane

Broadside Array

- Bidirectional Array
- Uses Dipoles fed in phase and separated by $1/2$ wavelength

End-Fire Array

- Similar to broadside array except dipoles are fed 180 degrees out of phase
- Radiation max. off the ends

Application of Arrays

An array of antennas may be used in a variety of ways to improve the performance of a communications system. Perhaps most important is its capability to cancel co channel interferences. An array works on the premise that the desired signal and unwanted co channel interferences arrive from different directions. The beam pattern of the array is adjusted to suit the requirements by combining signals from different antennas with appropriate weighting. An array of antennas mounted on vehicles, ships, aircraft, satellites, and base stations is expected to play an important role in fulfilling the increased demand of channel requirement for these services