

# Active-Feed Beam-Scanning Reflectarray Antennas

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**Abstract:** Printed microstrip reflectarray antennas have received considerable attention in the recent years due to their numerous advantages. They imitate the conventional reflector antennas by using a printed array of phasing elements [1]. As a result, they are low profile, low mass, and low cost, which makes them a suitable choice for long-distance and deep-space communications which require high-gain antennas. Active design adds a new dimension to reflectarray antennas by enabling them to achieve a dynamic radiation performance. Although active-element beam-scanning reflectarrays show a good performance with only 2 or 3 bits phase control, they are still quite challenging for high-gain operation due to the design complexity and fabrication expense [2]. In addition at higher frequencies the loss in the phase shifters also becomes a critical issue.

Active-feed systems on the other hand scan the beam by using a feed array rather than active elements, therefore minimizing the number of active components in the system, which makes them a suitable choice for high-gain beam-scanning operation. In this work we study the performance of bifocal reflectarray antennas for active-feed beam-scanning applications. It is shown that a bifocal reflectarray antenna is a good candidate for active-feed beam-scanning when limited scan angles are required. For wide-angle beam-scanning however, the conventional bifocal design cannot achieve a good scan performance. To improve the beam-scanning performance of these designs, the particle swarm optimization method is applied to optimize the phase of reflectarray elements. This study shows that active-feed reflectarrays can be a suitable low-cost choice when high-gain beam-scanning with moderately wide scan angles is required.

**Keywords:** beam-scanning, optimization, reflectarray antennas.

## References:

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- [2] R. C. Hansen, *Phased Array Antennas*, 2<sup>nd</sup> Ed., John Wiley & Sons, 2009.

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