

A Comparison Between the Currents of a Multi-Mode Spiral on Planar and Curved Surfaces

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A planar 4-arm spiral is capable of multi-mode operation (i.e., 3 modes). It has been previously shown that a single planar multi-mode spiral can be used for angle of arrival (AOA) estimation. Comparison of the phases of the mode-former outputs produces an estimate of the azimuth, which is often the primary angle of interest. Best phase accuracy is obtained when the highest order mode (e.g., mode 3) is used because it has the highest rate of phase change with angle. However, mode three phase has a phase ambiguity and that is resolved using the mode 1 (lowest order mode) phase output. Comparison of the magnitudes of the various modal outputs yields an estimate of the elevation angle.

For a planar multi-mode spiral, the magnitude and phases of the modal outputs have been accurately calculated and confirmed by measurement over a hemispherical range of angles. However, in many applications it is desirable, if not necessary, to conform the spiral to a curved surface such as that of a cylinder with circular cross-section. In order to use the multi-mode spiral for AOA in this situation, the changes in the magnitudes and phases of the modal outputs, from those in the planar case, must be known or predictable. It is the purpose of this paper to show such changes and how they affect the usefulness of the multi-mode spiral for AOA when conformed to the surface of a circular cylinder.

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- 1) Commission B, suggested Session B1.5, Mechanical Distortion Effects in Arrays and Reflectors
- 2) New knowledge: How conforming a multi-mode spiral to a curved surface affects its performance in an AOA application.
- 3) Relationship to previous work: It is an extension of recent work at WPAFB in the development of a wideband AOA system.