

The Triskelion-Archimedean Spiral Antenna

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Poly-spirals are composed of contiguously interconnected spiral elements and are ubiquitous in the monuments of various cultures since prehistoric times. In adopting poly-spiral geometries for antenna applications, we may in general choose these contiguously connected spirals to be identical or dissimilar, such as by selecting them to be of circular, eccentric, or polygonal shape. In this paper we focus on a special class of poly-spirals with circular elements, namely the Triskelion-Archimedean (Tri-Archimedean) spiral. The shape found at Newgrange, Ireland. The Tri-Archimedean spiral shape is of interested for antenna design because many different terminals are available for excitation or for variable impedance loading within a single antenna structure. In particular, by controlling the amplitude and phase of the excitation on its multiple terminals one can radiate circular polarization, obtain a broadband impedance response, and excite multiple radiation patterns.

These unique capabilities present additional degrees of freedom that can be exploited as diversity techniques in MIMO communication systems, and also to perform over-the-air power combining. From a system point of view, the Tri-Archimedean slot spiral antenna is a reconfigurable antenna that can generate a large set of distinct radiation patterns and polarization states. Also, the antenna has multi-band coverage and it can be used to improve the diversity gain, coverage, and capacity in multi-band 2GHz and 5GHz WLAN systems. Applications of interest for the poly-spiral antenna are: (a) in a ceiling WLAN router where conical patterns are desired, and (b) as a MIMO satellite antenna for automobiles. The performance of the antenna within a wireless communication system has been evaluated.

In this paper we also compare the radiation properties of the Triskelion-Archimedean (Tri-Archimedean) spiral antenna with those of a regular circular Archimedean of the same size and number of turns. Simulation and measurements results will be shown.