Coupled Antenna Arrays With Enhanced Angular Resolutions

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Biologically-inspired antenna arrays that mimic the hyperacute hearing characteristics of the parasitoid fly *Ormia Ochracea* have been recently reported. These biomimetic antenna arrays (BMAAs) consist of a two-element antenna array with closely spaced elements along with an external, passive coupling network (Behdad, et al., *IEEE Antennas Wireless Propagat. Lett.*, 10, 361-364, 2011). It has been demonstrated that such BMAAs can achieve directional sensitivities significantly larger than those of regular antenna arrays with the same aperture dimensions. Therefore, these antenna arrays are expected to find applications in areas such as compact direction finding systems and high-resolution, small-aperture radar systems. While passive BMAAs demonstrate higher angular resolutions compared to conventional arrays of the same size, this added capability comes at the expense of sacrificing the output power of the antenna. This means that the better angular resolution of these arrays comes at the expense of limiting the range over which acceptable received signal-to-noise ratios (SNRs) can be achieved.

In this work, a new coupled antenna array topology is presented, which addresses the shortcomings of the biologically-inspired antenna arrays reported previously. In particular, the new coupled antenna arrays proposed in this paper offer similar angular resolutions that can be achieved from two-element BMAAs. However, unlike previously reported BMAAs, they do not sacrifice the output power level to achieve this angular resolution. In this presentation, we examine a coupled antenna array composed of two receiving elements with a strong mutual coupling between the two elements. We then derive a theoretical bound for the maximum angular resolution that can be achieved from these arrays without paying a penalty in terms of the output power level. This analysis is then applied to a two-element antenna array operating at 600 MHz composed of two 13.5 cm monopole antennas separated by a distance of 2.5 cm. We demonstrate that for this antenna, the maximum achievable angular resolution that can be achieved without sacrificing the output SNR is roughly four times that of a regular array composed of the same elements with the same element spacing. Thus, the new coupled antenna arrays are able to obtain enhanced angular resolutions without sacrificing the output SNR.

Details of the design process and experimental measurement results of the proposed antenna will be presented and discussed at the symposium.