# A Technique to Eliminate Cross-Polarization Responses and Mutual Interactions between Circularly Polarized Antennas

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## Abstract

Cross-polarized responses and mutual interactions can cause unwanted sidelobes that sometimes have disastrous effects on system performance. In this short note I present a simple technique that should eliminate these effects.

## The Technique

This technique makes use of the simple fact that, if a circularly polarized antenna is rotated about its axis, one polarization is advanced in phase while the opposite polarization is retarded. If the antenna is rotated such that the phase of the desired polarization is advanced by π/2 radians and, simultaneously, the phase is retarded in the receiver chain by π/2 radians (via a phase shift in an LO, for example), the phase of the desired polarization is unchanged while the phase of the unwanted polarization is retarded by a total of π radians. I assume that the system is electronically controlled so that these operations can be completed on a microsecond time scale. If the antenna is then cross correlated with another antenna and a switching cycle between the two states is arranged so that the antenna spends equal time in each state, the signal of undesired polarization is eliminated. This technique is analogous to phase switching and synchronous demodulation; the phases of undesired signals are inverted for one half of each switching cycle.

In an array of circularly polarized antenna elements it is easily shown that the signals induced by mutual coupling in other array elements by a signal in any one element are of opposite polarizations. Therefore, this technique should be capable of eliminating the effects of mutual coupling. Ideally, to eliminate coupling in a large station of, say, 128 or 256 elements, a complex switching pattern of

orthogonal functions would be required. Seventh or eighth order Walsh functions would be needed, for example. However, mutual coupling is appreciable only between adjacent or nearly adjacent elements so separated elements could be switched reusing the same function without deleterious effects and much lower order functions, such as third or fourth order Walsh functions should suffice.

## Conclusions

This technique may be of great importance to the next generation of low frequency telescopes or to any system in which circularly polarized elements are cross-correlated. However, is so simple that it must have been considered and either rejected or implemented on some previous occasion. If so, there is little point in my discussing it here in more detail. I do not know of any such consideration or implementation and would appreciate it very much if any reader could inform me of such work.