Element Failure Detection in Antenna Arrays Using Neural Networks

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Abstract

Methods are developing to compensate for the defective elements in antenna arrays to maintain the pattern as closely as possible with that of the original array[1,2]. But in order to apply those methods, first of all it is required to know the failed element positions, mostly in inaccessible situations like space borne applications, where it is not possible to repair/replace the failed element(s). After knowing the failed element positions, the excitations of other elements can be modified suitably to maintain the array pattern. The present work deals with the use of neural networks for the detection of the failed elements in arrays at the controlling center by observing the pattern of the defective array. The job of the network here is to form a mapping between the array pattern and the failed element position(s). A feed-forward neural network trained in backpropagation mode serves this purpose [3]. The developed algorithm is tested for a linear array and the methodology can also be extended to planar arrays [4]. The benefit of using neural networks is its fast response time and so can be used for real time applications.

References

[1] Peters, T. J., "Conjugate gradient-based algorithm to minimize the sidelobe level of planar arrays with element failures," *IEEE Trans. Antennas Propagatio*n, vol. 39, pp. 1497–1504, 1991.
[2] Yeo, B. and Y. Lu, "Array failure correction with a genetic algorithm," *IEEE Trans. Antennas Propagation*, vol. 47, pp. 823–828, 1999.
[3] S. Haykin, Neural Networks: A Comprehensive Foundation, IEEE Computer Society Press/IEEE Press, 1994
[4] C.A.Balanis, "Antenna Theory: Analysis and Design", John Wiley, 1997.