

# Analysis and Optimal Design of Vertically and Horizontally Corrugated Monopole Antenna

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## Abstract

This paper presents the analysis and optimal design of two new types of broadband antennas, a vertically corrugated monopole antenna and a horizontally corrugated monopole antenna by using the modal expansion analysis and genetic algorithm. The structures of these two antennas are shown in Fig. 1. The antennas are fed through infinite grounding plane by coaxial cables with the monopole shaped in corrugated form to broaden the bandwidth. Most traditional analyze of monopoles are based on method of moments (MOM), for which the impedance results and the accuracy are often not satisfactory. The modal expansion analysis technique (Z. Shen and R.H. MacPhie, *Radio Sci.*, 5, 1037-1046, 1996 & Z. Shen and R.H. MacPhie, *IEEE Trans. on Antennas and Propagat.*, Vol. 49, No. 11, 1525-1531, 2001) is a more accurate and efficient method for axis-symmetric cylindrical antenna structures. It is applied in this paper to compute the electromagnetic fields and input impedance response of the proposed antennas. To achieve better

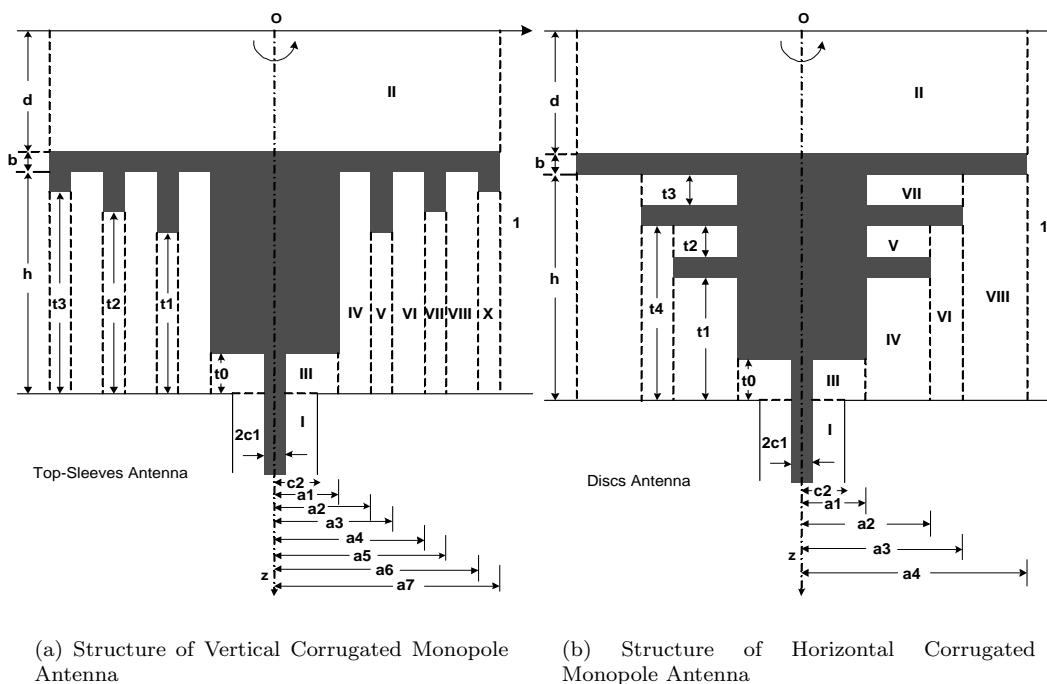


Figure 1: Two Corrugated Monopole Antennas Fed by Coaxial cable

and more stable bandwidth performance of the desired antennas, the effective Emperor-Selective genetic algorithm (EMS-GA) (B K Yeo and Y Lu, *IEEE Trans. on Antennas and Propagat.*, Vol. 47, No. 5, 823-828, 1999) is applied for automatical optimization. Genetic Algorithms are stochastic search and optimization techniques modelled on the mechanics of biological genetics and natural evolution. It becomes very popular in optimization of many engineering problems today. In EMS-GA, real number vectors associated with the proposed antennas' geometrical dimensions are used as the chromosomes. The optimally designed antennas can achieve very wide bandwidth. The performance of these two proposed antennas are compared. The effects due to the vertical and horizontal corrugates are analyzed and discussed.