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ANALYSIS AND DESIGN OF HORN ANTENNAS WITH ARBITRARY PROFILE USING MODE-MATCHING

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Horn antennas belong to the family of aperture antennas. They usually consist of a waveguide whose transverse section increases along the longitudinal dimension, allowing the wave that propagates inside the waveguide to propagate in free space (air, vacuum...). These antennas present high values of directivity and gain that, along with its physical robustness and high efficiency, make them perfect candidates for critical applications like aerospace communications.

Abstract The main drawback of horn antennas is, as with most microwave devices, the difficulty in performing the required computations for their analysis and design. With the coming of CAD tools this problems have been reduced but they are still far from being completely solved. Most commercial CAD tools employ general-purpose numeric techniques (like Finite Differences Method and Finite Elements Method) what is a good idea since it allows using the same software to simulate a wide range of devices. The disadvantage of these methods lies on the fact that this generality comes at a cost, the loss of efficiency. On the other hand, quasi-analytical techniques are usually more efficient but they can only work with a narrow spectrum of problems [1].

Abstract The main objective of this work is to develop a software tool capable of analyzing, simulating and designing horn antennas efficiently. To accomplish this, a quasi-analytical method called Mode-Matching would be used. The high computational efficiency achieved by this method will make this implementation specially suited to be combined with an optimization algorithm in order to get an automatic design tool that, given a set of specifications on the radiation characteristics, would give a description of a horn fulfilling them [2].

[1] A. Wexler, "Solution of waveguides discontinuities by modal analysis," IEEE TMTT, sep 1967.

[2] A. Ludwig, "Radiation pattern synthesis for circular aperture horn antennas," Antennas and Propagation, IEEE TAP, jul 1966.