Abstract

A full-wave and rigorous formulation is presented for the analysis of multiple loops around a conducting cone, considering mutual coupling between the loops. The analysis has been used to characterize the return loss and radiation performance of a single and a two- loop system around the cone and to investigate the effect of a parasitic loop on the coupling characteristics of the excited loop. It is observed that the matching characteristics of a single loop around the cone is significantly better compared to an isolated loop. A stronger excitation of the first harmonic loop current is also observed for the loop around the cone compared with the isolated loop case. In addition, it is also observed that the directivity and cross-pol characteristics for the loop around the cone are improved compared to that of the isolated loop, the latter due to the induced current on the cone being oppositely directed to the loop current and reducing the cross-polar component. A two-loop system above the cone tip has been also investigated using the method. It is observed that the matching characteristics of the primary loop in this case can be significantly improved by the introduction of a parasitic loop at an appropriate location. The return loss and radiation characteristics of a three-loop director-reflector configuration was also investigated with loops below and above the cone-tip. It is observed that for the antenna structure, the beam-width is more sensitive to the director radius compared to the director height. The beam-width and matching could also be independently controlled by the director and reflector respectively. Next, the full-wave technique is extended to the analysis of a loop antenna system around and above a composite body consisting of a conducting cone with a spherical cap. It is seen that the latter structure can offer a good impedance match to a single loop above the cone, without the necessity of a parasitic loop. The theoretical results for the above antenna structures are verified using simulation and measurements.

Keywords : Cone, loop, mutual coupling, full-wave, multiple-loop.