



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI  
SHORT ABSTRACT OF THESIS

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Programme of Study : Ph.D.  
Thesis Title : ANALYSIS AND DESIGN OF MATCHED FEEDS FOR OFFSET PARABOLIC REFLECTOR ANTENNAS USING ANALYTICAL AND NUMERICAL TECHNIQUES  
Name of Thesis Supervisor(s) : Prof. Ratnajit Bhattacharjee  
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This research deals with the analysis and design of few novel matched feed structures for offset parabolic reflector antenna systems. An effective hybrid numerical technique is developed to evaluate the performance of a complete system of feed and reflector which reduces computation time and memory requirement at the same time maintain appropriate level of accuracy. The hybrid technique is formed by using the combination of mode matching (MM) and 2-D finite element method (FEM) for interior field analysis of horn; method of moment (MoM) solution for Kirchoff Huygen's equation using Rao, Wilton and Gilsson (RWG) basis functions for open ended waveguide problem; physical optics (PO) to evaluate the far field radiation pattern of the reflector. The performance of this technique is compared with simulated results of HFSS and close match is obtained. Further, particle swarm optimization (PSO) technique and analytical or computed semi-analytical far field pattern of feed aperture using the available analytical or 2-D FEM based solution of Helmholtz equation respectively, are incorporated for conjugate matching to estimate the mode coefficients and relative phases in the matched feed design. In this thesis, the detail of conjugate matching and matched feed design is investigated and also, few novel matched feed configurations are introduced. The proposed matched feed structures reported in this thesis have the ability to achieve the wide bandwidth for both return loss and conjugate matching.