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Brief 68-10421

NASA TECH BRIEF

Computer Program for Machine Design of Cassegrain Feed Systems

The problem:

To develop a method, based on knowledge obtained in the design of the Deep Space Instrumentation Facility (DSIF) Advanced Antenna System (AAS) feed systems, for the design of Cassegrain antenna systems.

The solution:

A program which designs the feed system geometry and the subreflector surface, with the main reflector configuration and frequency of operation as input data. Although the feedhorn is not designed, its required gain, beamwidth, and approximate radiation pattern are specified.

How it's done:

The program assumes a paraboloidal main reflector, and designs a subreflector consisting of the following parts: (1) hyperboloid, (2) vertex matching plate, and (3) beamshaping flange. The first and third items are designed primarily from geometric considerations. The vertex plate is designed by a spherical wave synthesis procedure, together with a perturbation technique for improved VSWR performance.

The input to the program includes the paraboloidal focal length, the paraboloidal diameter, the frequency of operation, the output data polar angle increment, the required VSWR of the subreflector as seen by the feedhorn, and various user options which allow for differing degrees of sophistication. One such option allows the operator to override the machine wave order choice for diagnostic purposes. Another option allows the user to decide between the small or large vertex plate. The printed output of the program consists of (1) a list of all inputs, (2) a diagnostic output of certain internal operations, (3) the feed system VSWR (with and without matching plate), geometrical parameters and horn beamwidth-gain, (4) a table of subreflector coordinates (with initial spherical wave vertex plate design), and (5) VSWR values for a redesigned vertex plate, subreflector coordinates, and assumed horn radiation pattern. The redesign will be effected only if the initial (spherical wave) vertex plate design does not meet the input VSWR requirement.

Upon reading the input data, the program performs the initial subreflector surface design. It then evaluates the VSWR of the initial vertex plate design and perturbs the surface for a better match, if required. In addition, the program corrects the vertex plate design in the event that a depression (relative to a hyperboloid) has resulted. Finally, the program reduces the beamshaping flange width in the event that it is unnecessarily wide in relation to the horn radiation pattern which has been generated.

Notes:

1. This program is organized to permit periodic upgrading as more engineering information and requirements become available.
2. This program is written in Fortran IV for use on the IBM 7094 computer.
3. Inquiries concerning this program should be directed to:

   COSMIC
   Computer Center
   University of Georgia
   Athens, Georgia 30601
   Reference: B68-10421

Patent status:

No patent action is contemplated by NASA.

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