NASA TECH BRIEF

Computer Program Aids Dual Reflector Antenna System Design

The problem:

To develop a program that will provide dual reflector configurations based on input parameters to aid in the design of maximum efficiency dual reflector antenna systems. The output should indicate minimal modifications to an existing paraboloidal main reflector.

The solution:

A computer program which can design a shaped Cassegrainian antenna which has nearly 100% efficiency due to a practically uniform aperture illumination. The program can also accept input parameters specifying an existing conventional antenna and produce as output the modifications necessary to conform to a shaped design.

How it's done:

The program constructs, based on input data, the amplitude function, $F(\theta)$, the phase function, θ, and the phase derivative θ'. These three functions augment the input data to become the basic working table for the program.

For each set of input parameters, the initial conditions and the constant integral

$$C_2 = \frac{2}{X_{max}^2} \int_0^{\theta_{max}} F(\theta) \sin\theta \, d\theta$$

are evaluated. At this point, the program splits into two alternate sections: Phase A and Phase B.

Phase A finds an optimum y-coordinate, A, for the feed location, that is, the coordinate which minimizes the root mean square of normal error between Y(X), the y-coordinate of the main reflector, and $Y_N(X)$, that of the nominal reflector. The program goes to the next set of input parameters when it has found optimum A and also if it is established that A cannot be found within the search range specified.

If the maximum search increment of the y-coordinate is input as zero, the program enters Phase B where the main reflector is found for the given A. Additional calculations produce: root mean square of normal error, RMS, between Y(X) and $Y_N(X)$; shift, in inches, of $Y_N(X)$ to minimize RMS; and the maximum and minimum normal errors between Y(X) and $Y_N(X)$.

Results are printed out and an option is included for the punching of both results and a summary.

Notes:

1. This program is written in Fortran IV and MAP for use on the IBM 7094 computer.
2. This program can be used by electrical engineers and physicists engaged in high efficiency reflector antenna design.
3. Inquiries concerning this program may be addressed to:

   COSMIC
   Computer Center
   University of Georgia
   Athens, Georgia 30601
   Reference: B68-10139

Patent status:

No patent action is contemplated by NASA.

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