NASA TECH BRIEF

CINDA: Chrysler Improved Numerical Differencing Analyzer Computer Program

The problem:

To develop a multioption systems computer program that constructs and analyzes a mathematical model of any arbitrary one, two, or three dimensional lumped parameter representation of a physical system. The program should automatically optimize the utilization of computer core space and should be more general and versatile than BETA (Boeing Engineering Thermal Analyzer) which is primarily limited to thermal analysis. A numerical analyzer program which solves a set of diffusion equations and the state variable could represent field and flow potentials other than temperature.

The solution:

CINDA is a dimensionless, multioption systems compiler computer program. It constructs and analyzes a mathematical model of any arbitrary one, two, or three dimensional lumped parameter representation of a physical system governed by a set of diffusion equations, i.e., the Fourier equation with an additional source term.

How it's done:

To utilize the program, a user must construct a thermal analog network representation of the physical system, uniquely number all of the elements, and input the information in the required format. Nonlinear material properties and boundary conditions may be calculated simultaneously as a function of one or more independent variables. Nonlinear transfer functions may be treated as effective nonlinear transfer properties and handled in the above manner.

The program options offer the user a variety of methods for the solutions of the set of simultaneous equations each differing in machine speed, core space required and solution accuracy. A wide variety of computational subroutines are available and are continually being added to the program. These subroutines do or will make available to the user various methods of calculating aerodynamic and orbital heating rates, several methods of computing convective heat transfer coefficients, and several methods of calculating material phase changes (ablation, sublimation, and vaporization). In addition, the program can solve a set or sets of simultaneous equations of the Poisson type either by relaxation or exact methods. The diffusion and Poisson sets may be coupled in any desired manner to yield the solution of a simultaneous system of equations. This capability has been successfully applied to rather large incompressible thermal fluid flow problems.

Notes:

1. The machine requirements are an IBM 7090 or 7094 computer.
2. The present program is written in 95% Fortran II and 5% FAP, but a Fortran IV version suitable for third generation computer and a Fortran V version for the Univac 1108 computer will soon be available.
3. This program is an updated version of the Boeing Engineering Thermal Analyzer (BETA) program, which is described in Tech Brief 66-10404, "New Computer Program Solves Wide Variety of Heat Flow Problems" (Sept. 1966).

4. Inquiries concerning this program may be directed to:

    COSMIC
    Computer Center
    University of Georgia
    Athens, Georgia 30601
    Reference: B67-10278

Patent status:

No patent action is contemplated by NASA.

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