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NASA TECH BRIEF

CINDA-3G: Improved Numerical Differencing Analyzer Program for Third-Generation Computers

The problem:

To develop a new and versatile program to supplement or replace the original CINDA thermal analyzer program in order to take advantage of the improved systems software and machine speeds of the third-generation computers.

The solution:

CINDA-3G, developed for third generation computers, is virtually identical to the original CINDA; but it has been almost completely rewritten to take advantage of the improved systems software and third-generation computers.

How it's done:

CINDA-3G provides a complete update to handle the job. Whereas CINDA was virtually a self-contained program having its own Update, Monitor, and Compiler, the CINDA-3G foundation consists of a preprocessor which accepts the same user input data and converts it to advanced FORTRAN subroutines and block data input which is then passed onto the system FORTRAN Compiler. While this requires a double pass on data where previously only one was required, the increased speed and improved software of the third-generation machines more than compensate.

The CINDA-3G program options offer the user a variety of methods for solution of thermal analog models presented to it in a network format. The network representation of the thermal problem is unique in that it has a one-to-one correspondence to both the physical model and the mathematical model. This analogy enables engineers to quickly construct mathematical models of complex thermophysical problems and prepare them for program input. In addition, the program contains numerous subroutines for handling interrelated complex phenomena such as sublimation, diffuse radiation within enclosures, and simultaneous 1-D incompressible fluid flow, including valving and transport delay effects. The optional combination of these capabilities in conjunction with model size allowable (>4000 nodes for a linear 3-D system on 65K core) makes CINDA-3G a very potent analytical tool for thermal systems analysis.

The program is virtually identical to its predecessor (CINDA), which is a dimensionless multioption systems compiler program. It constructs and analyzes a mathematical model of any 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. 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.

Notes:

1. The program is written in FORTRAN V and SLEUTH II assembly language for use on the UNIVAC 1108 computer.
2. This updated program will ultimately replace the original CINDA program, Tech Brief 67-10278.

(continued overleaf)

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