May 1972 CORRECTED COPY B72-10253

NASA TECH BRIEF

Lewis Research Center

Computer Program Draws Three-Dimensional Surfaces

The problem:

Many fields such as mathematics, physics, and engineering are concerned with the study of functions with two variables. These functions are conventionally represented by tables or crossplots, both of which are difficult to use. Three dimensional plots of these functions are easier to analyze.

The solution:

A computer plotting program, PLOT3D, can draw views of any three dimensional surface which is of the form z=f (x,y). Inputs to PLOT3D are the function f and bounding values for x and y. The surface thus defined by PLOT3D may be drawn after arbitrary rotations. Output is by off-line incremental plotter or on-line microfilm recorder.

How it's done:

Several computer programs for plotting three-dimensional surfaces have been developed elsewhere. Each has its advantages and limitations. Some are intended primarily to show the spatial relationships among solids; others draw surfaces made up of data points (such as programs to draw contour maps). PLOT3D will plot any function of the form z=f (x,y). The program calculates the function for a range of values of the two independent variables, defining the surface. Rotated views of the surface are made by simple matrix operations.

Notes:

1. This program is written in FORTRAN IV for use on both the IBM 7044/7094 direct-coupled computer and the IBM 360/67 computer.
2. With curve fits, PLOT3D has drawn experimental data, and has been used to make motion pictures and illustrations.
3. The output drawings are presently on graph paper or microfilm, but the program can be adapted to other media, for example, an oscilloscope.
4. PLOT3D can portray the behavior of various functions involving two variables such as in the following engineering, physics, and mathematical relationships:
   a. phase diagrams and equations of state for thermodynamics;
   b. energy surfaces and potential wells in mechanics; and
   c. mapping of the analytical and numerical solutions of partial differential equations found in heat flow, electricity and magnetism, fluid dynamics, and quantum mechanics.
5. Requests for further information may be directed to:
   COSMIC
   112 Barrow Hall
   University of Georgia
   Athens, Georgia 30601
   Reference: LEW-10482
6. The following documentation is available from:
   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $6.00
   (or microfiche $0.95)

   Reference: NASA TMX-1598 (N68-28240), PLOT3D - A Package of FORTRAN Subprograms to Draw Three-Dimensional Surfaces

Patent status:

No patent action is contemplated by NASA.

Source: R. B. Canright, Jr., and P. Swigert
Lewis Research Center
(LEW-10482)

Category 09