TWO VARIABLE FUNCTION GENERATOR PROGRAM FOR HYDAC*

INTRODUCTION

These notes describe the capabilities of a HYDAC program for the generation of arbitrary functions of one or two variables. The realistic simulation of most physical devices and systems requires such capability to describe mathematically, physical phenomena involving the variation of quantities as functions of other quantities.

Functions of a single variable are satisfactorily represented in analog simulations by the Diode Function Generator or the Pot Padder. Functions of more than one variable are not handled so easily, however, and their representation is made usually by approximation even after considerable experimentation.

The HYDAC program used in the study described is an effective and economical means for representing functions of one or more variables with convenient, rapid setup from punched paper tape. It is designed to expand the problem solving capability of the analog computer by providing, through the general purpose components of the EAI Digital Operations Systems (DOS), flexible, accurate, and rapidly set function generators for the simulation of arbitrary functions of analog voltages.

BENEFITS

Several benefits are provided through this simulation technique. The DOS Function Generator program is a general purpose HYDAC program implemented by the interconnection of a portion of the complement of components in the DOS. It is possible, then, to use those DOS components not used in the Function Generator program for additional logic control and computing functions.

Added to this flexibility are the economics of component time sharing which make the program a doubly attractive addition to the analog or hybrid simulation laboratory.

GENERAL DESCRIPTION

In the diagram of Figure 1, the characteristics of the Function Generator Program -- referred to as F(x,y) -- are defined uniquely by the input - output relationships shown. Figure 2 is a block diagram of the basic F(x,y) program, showing the major operations.

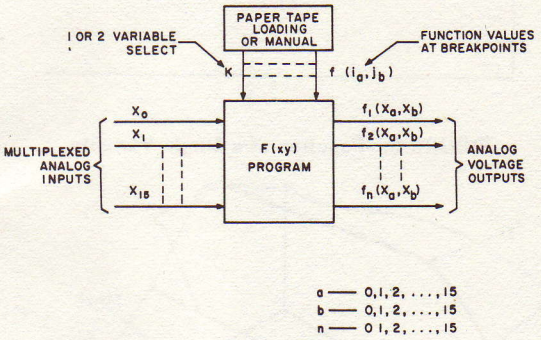

FIGURE 1. General Characteristics of F(xy) Program for HYDAC

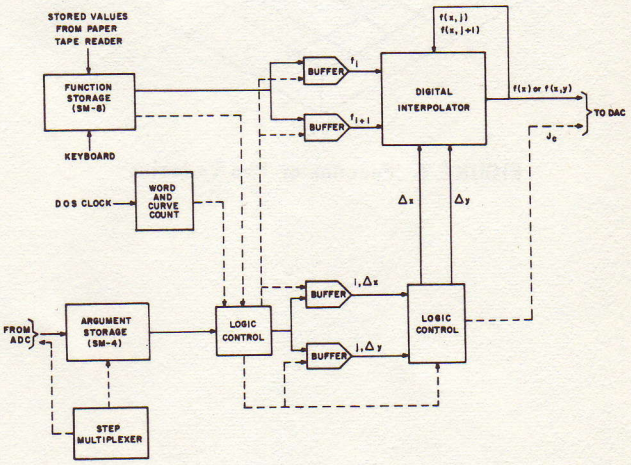

FIGURE 2. Block Diagram of F(xy) Program

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PROGRAM OERATION

In the F(x,y) program, a curve is considered to be described by 15 straight line segments (Figure 3) that connect values of a function, f(x), defined at 16 evenly spaced values (breakpoints) of the variable, x. A function of two variables is defined by several curves, one for each breakpoint of the second variable, y (Figure 4).

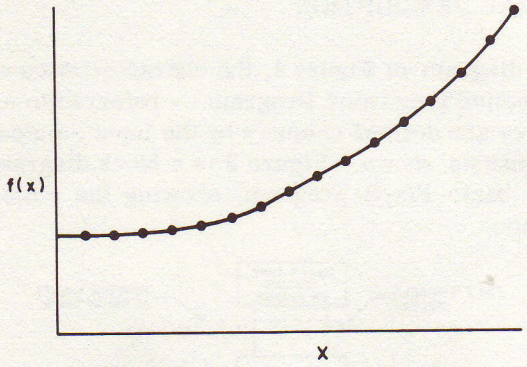

FIGURE 3. Function of a Single Variable

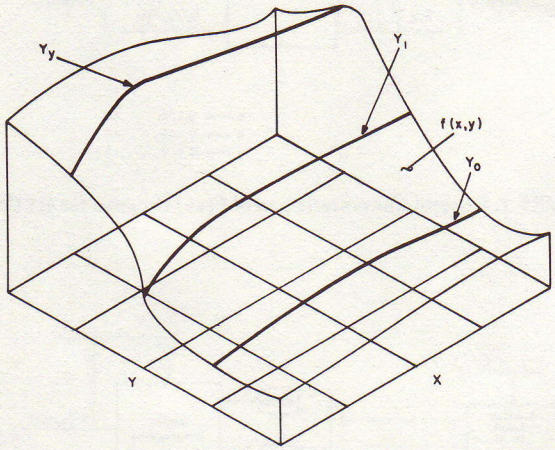

FIGURE 4. Function of Two Variables

With suitable interpolation between values of the function at breakpoints, a function of two variables, f(x,y), defined by Y curves, can be represented by 16 Y data points, each of which defines the value of functions at breakpoints in X and Y.

Figure 5 is a diagram illustrating the interpolation scheme used in the F(x,y) program. Linear interpolation is used for both one and two variable generation.

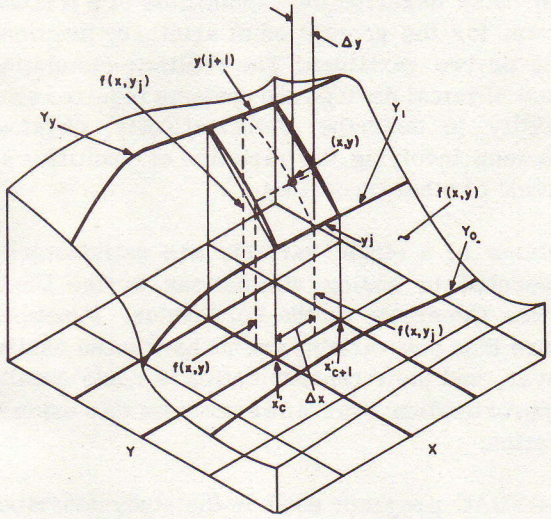

FIGURE 5. Diagram Illustrating F(xy) Interpolation Scheme

With additional buffering and control circuitry, the F(x,y) program can be expanded to include the generation of Variable Break Points and Functions of Three Variables.

For complete details on the basic F(x,y) program, please write for Application Study 1.3.6h, Bulletin No. ALHC 6384-lab.

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