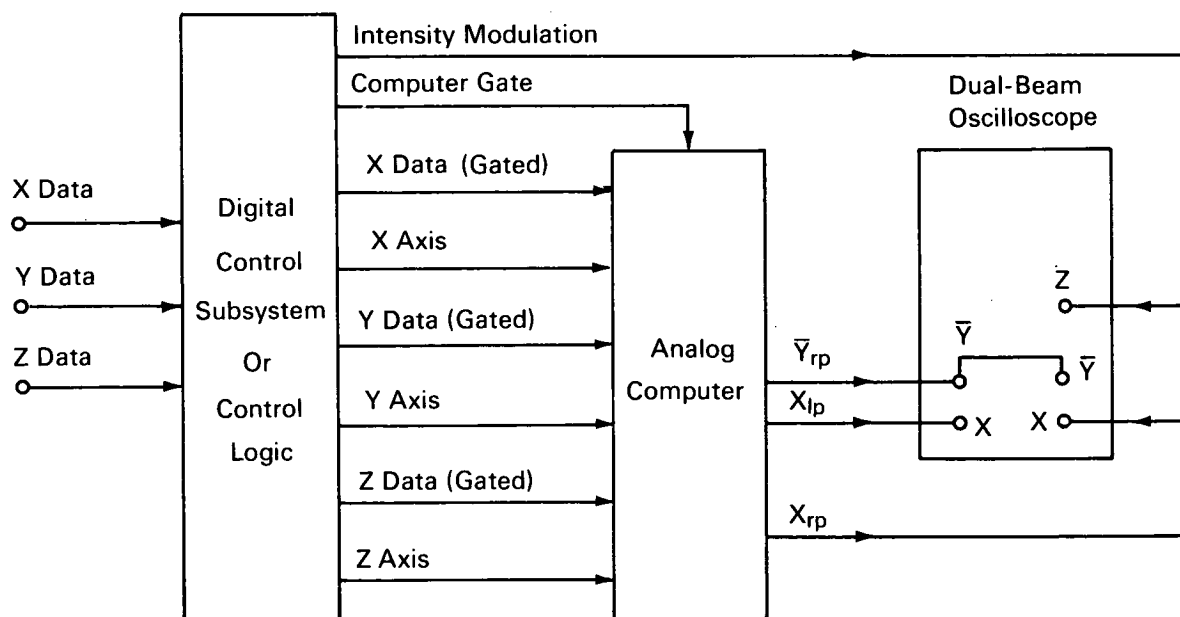


NASA TECH BRIEF



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Study Made of Application of Stereoscopic Display System to Analog Computer Simulation



In system simulation, it is often desirable to present simultaneously several variables. Common display devices display only two variables. Some cathode-ray oscilloscopes provide for an external intensity-modulation input which increases to three the number of variables represented by a single trace. However, the intensity-modulated data is of qualitative nature and does not lend itself to quantitative measurement. It is useful to have a visual display system which provides both a qualitative and measurable presentation for functions of several variables.

A primary application of such a display system is in analog computer simulation of sets of differential equations. If the system with the aid of an oscilloscope and high iteration rate simultaneously presents three variables on a single display, then such data as roll, pitch, and yaw of a missile; range, azimuth, and elevation from a radar system; or position, velocity, and acceleration of a control system can be viewed at the same time. Gains, feedback, and/or compensation can then be adjusted while observing the effects of their change on the system operation. Since an analog

(continued overleaf)

computer is available for the simulation, the inclusion of certain computer functions as inherent elements of the display system is permissible.

The block diagram of a system capable of simultaneously displaying three variables is shown. When used with an optical adapter, it converts a normal dual-beam oscilloscope into a stereoscopic, three-dimensional viewing system. The intensity-modulation input can either be used to present qualitatively a fourth variable or to present a superimposed slow trace simultaneously with the fast trace (the fast trace, to appear stationary, has to be repeated at least 25 times per second).

The X, Y, and Z data inputs may be from any source, but should be restricted to frequencies compatible with the particular analog computer. For most applications, the data is generated within the analog computer, but it is easily visualized that data could come from a digital memory when, for example, displaying the spatial distribution of atoms in a complex molecule.

The digital control subsystem or control logic provides synchronization of the analog computer, intensity modulation signals for the oscilloscope, gating input data, and a set of coordinate axes for the oscilloscope display.

Certain elements of the analog computer are used to implement the projection and rotation equations. The latter allow the coordinate axes and the data display to be rotated to provide the observer with

various perspective views. The analog computer outputs serve as inputs for the oscilloscope display.

Notes:

1. The X,Y,Z information does not have to come from the solution of a set of differential equations. The display can also be used to show spatial point distributions, surfaces, body outlines, etc. What can be shown is only limited by the operator's ingenuity (and equipment) of how to present all the X,Y,Z information repetitively more than 25 times per second.
2. A detailed description of the display can be found in IN-R-ASTR-65-7, "A Three-Dimensional Display", by H. F. Kennel, MSFC, March 12, 1965, which may be obtained from:
Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama 35812
Reference: B66-10590
3. A slightly different implementation, is described in NASA CR-61116, "A Steroscopic Display System," by D. W. Russell, Auburn University, Alabama, December 1965, which also may be obtained from the above Technology Utilization Office.

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: H. F. Kennel

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