NASA TECH BRIEF

Simplified System Displays Complex Curves Corresponding to Input Data

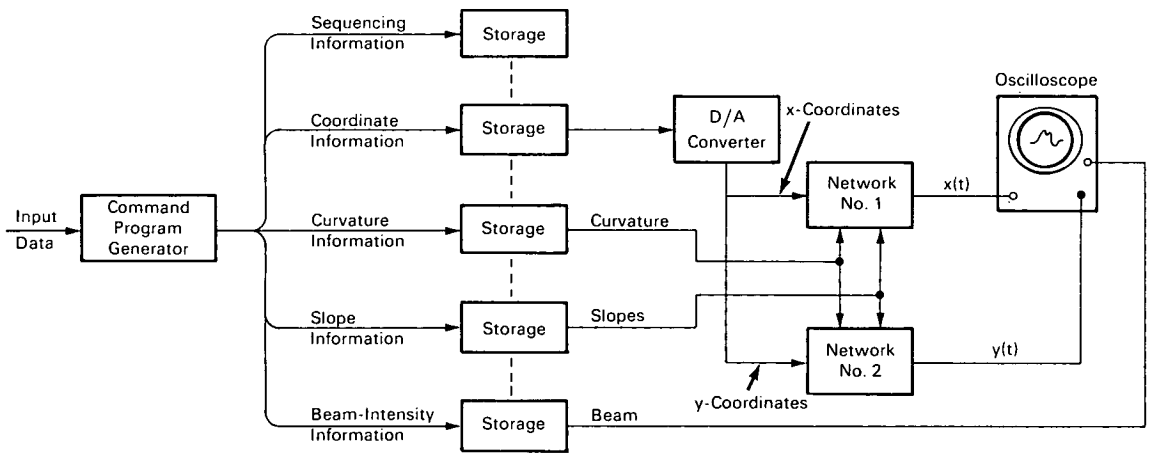

Figure 1

A relatively simple, inexpensive system has been devised to display curves or contours of complex shapes. The curves are displayed on a cathode ray oscilloscope and represent very good approximations of actual plots corresponding to sets of x,y coordinates. The new system requires comparatively few storage facilities and produces a rapid display of a highly complex curve with a fewer number of commands than are required in any previously known systems. The latter characteristic is especially significant when the system is used with on-line computers, particularly those which are to be time-shared by many users.

The system, Figure 1, digitally stores the information from a command program generator which specifies (1) the initial and final coordinate positions of each of several curve segments comprising the complex contour, (2) the curvature of each segment between the initial and final coordinate points, and (3) the initial and final slopes of the segments. For display on a cathode ray tube, beam intensity information is also needed to indicate the times when the beam is either *on* or *off*. Once the command information has been stored, the system rapidly synthesizes the overall complex contour by sequentially reproducing each segment of the contour. To reproduce each segment, the initial and final coordinate information for that segment is converted from a digital to an analog form. This conversion provides a step-function input signal which is applied to a pair of networks (No. 1 and No. 2). These networks generate specified analog output signals in response to the step-function input signals. The parameters of the networks are determined by the digital curvature and slope information stored from the command program generator. The output signals from the networks, representing time-varying x and y functions (i.e., x(t) and y(t), respectively), are then fed to

(continued overleaf)

a suitable display device, such as the X and Y input terminals of a cathode ray oscilloscope tube, where the specific curve segment is displayed. The input step-function and network-parameter values are then sequentially changed to reproduce the succeeding segments until the overall contour has been reproduced and displayed on the oscilloscope.

The command program can be generated by any known technique, such as, for example, through the use of a software program translator capable of accepting input data and producing a suitable command program for the display system. The networks (No. 1 and No. 2) for generating the sequence of desired curve segments are designed to produce a large family of waveforms having different slopes and curvatures in response to the step-function inputs. Various network configurations may be devised for this purpose.

Figure 2 represents an automobile silhouette reproduced by the display system. Reproduction of this complex contour required only 30 curve segments (and fewer than 100 sets of commands). This number of segments can be contrasted with the use of several hundred points which would be necessary for a piece-wise linear approximation by a point-by-point plot of the same drawing.

The type of display presented by this system should be most advantageous in cases where standard parts, or curve segments, are repeatedly used. In such cases, the commands required to reproduce the segments need only be formulated once and can be repeatedly used. The system has also proven useful even in cases where a particular curve had to be reproduced only once.

Note:

No further documentation is available. Inquiries may be directed to:

Technology Utilization Officer
Headquarters
National Aeronautics and Space Administration
Washington, D.C. 20546
Reference: B69-10247

Patent status:

Title to this invention has been waived, under the provisions of the National Aeronautics and Space Act [42 U.S.C. 2457 (f)], to the Massachusetts Institute of Technology, Cambridge, Massachusetts 02139.

Source: M. L. Dertouzous and H. L. Graham of Massachusetts Institute of Technology under contract to NASA Headquarters (HQN-10073)

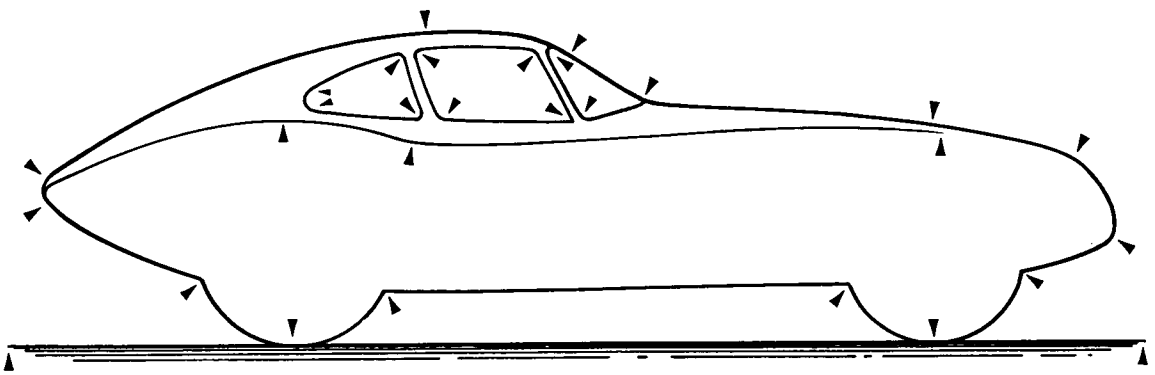

Figure 2