

Communications

A Digital Differential Analyzer in Two Coordinates

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An automatic digital differential analyzer in two coordinates is described. The system uses digital integrators built with standard integrated circuits.

An integrator is considered as a device which receives two input rates and transmits one output rate, where the input and output rates for an ideal integrator are related as follows.^{1,2}

$$\frac{dz}{dt} = k \left(\int \frac{dy}{dt} \cdot dt \right) \frac{dx}{dt} \quad \dots(1)$$

where dx and dy are the integrator's input lines, and dz its output line.

With very little hardware (electronics) it will be seen that a number of linear or regular paths can be transcribed. Consider the two pairs of integrators shown in Figs. 1 (a) and (b). Fig. 1 (a) describes a linear path from any initial position to any final position (X, Y). Initially, both ΔX and ΔY are preset to zero. X and Y are set to final required positions. X is then added to ΔX to form a new ΔX until an overflow occurs. The overflow in ΔX causes the X drive motor to step and a 'One' is subtracted from X . A similar sequence of events occurs also with $Y, \Delta Y$ and Y drive. This process is continued until both X and Y are equal to zero. This system has the feature that the frequency of the drive automatically decreases as the motion reaches its destination.

Circular motion is accompanied by interconnecting the integrators as shown in Fig. 1 (b). X is subtracted from ΔY to obtain a new ΔY . Whenever ΔY underflows, a 'One' is borrowed from Y . Y is

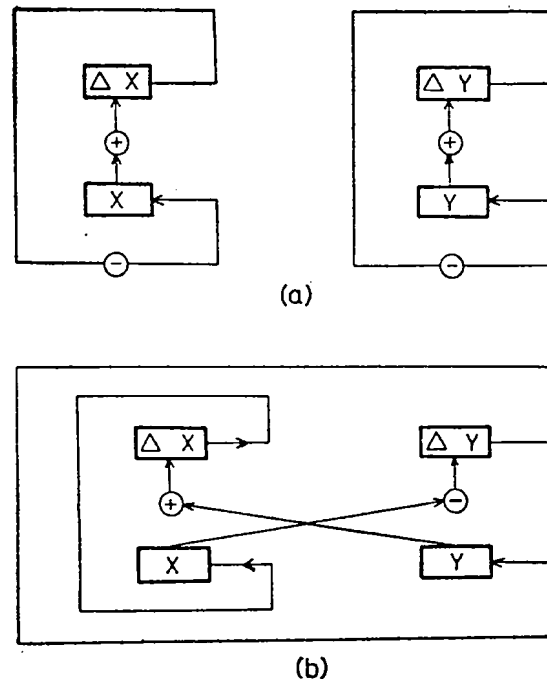


Fig. 1—Diagram showing the working of digital integrator for DDA in two coordinates: (a) Linear motion (b) Circular motion

added to ΔX and whenever ΔX overflows, a 'One' is added to X . This constitutes a DDA in two coordinates. The result is incremental steps in a circular path. This type of operation can be extended to n dimensions.

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References

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