

NASA TECH BRIEF

Marshall Space Flight Center



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Errors in Hybrid Computers

The problem:

In any hybrid computer there exist inherent system sampling errors.

The solution:

A method has been devised for the reduction of a particular group of error components, namely in:

- (1) numerical integration
- (2) sampling with zero hold order
- (3) execution time delay.

How it's done:

In any numerical integration method which produces solutions to differential equations at discrete values, the step size is the difference between successive values at which solutions are produced. This is usually a constant figure. There exists a principal error function of any numerical method used in conjunction with hybrid computers caused by truncation and analog sampling errors. The choice of optimum numerical integration method depends on analog to digital (A/D) and digital to analog (D/A) timing requirements, required data conversion storage, and execution time.

Digitally generated functions coupled to analog computers through zero hold (D/A) converters produce errors directly related to the sampling period (δ). In order to

effect a reduction in error, the error must be made dependent on powers of δ higher than the first. This is done by replacing the zero order hold devices with first order hold devices. The sampling period is not changed.

Execution time delays of digital computations for use by the analog computer is another source of error. By proper sequencing, extrapolation, and estimation, this error component can be reduced.

Note:

Requests for further information may be directed to:
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No patent action is contemplated by NASA.

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