NASA TECH BRIEF

Marshall Space Flight Center

Selecting Digital Filters

The problem:

To determine the effect that a filter has on the frequency domain of an input data function of a digital filter, numerous parameters must be evaluated.

The solution:

A technique has been developed which reduces the task of filter design to selecting only three parameters.

(1) cut off frequency (f_c) - the highest frequency whose amplitude is passed with unity gain.

(2) termination frequency (f_t) - the lowest frequency whose amplitude is passed with zero gain.

(3) weight number (n) - a proportion that contributes to the total response value.

How it's done:

A filter consists of a sequence of weights, each of which determines the proportion that contributes to the filtered value. It selectively shapes the amplitude or phase, with respect to frequency, of an input function in order to meet an operational requirement. A low pass filter would remove frequency components which exceed a specified value, while not affecting the lower frequencies.

The parameters f_c, f_t, and n must be chosen so that an adequate response $g_i(f)$ is produced which closely approximates the ideal response g(f).

The effects of varying f_c while holding n and $\Delta f = f_t - f_c$ (roll off bandwidth) constant, contributes to the loss of data points. When f_c and f_t are constant and n is increased, the response improves. Therefore, g(f) has a sharper roll off; side-lobe amplitudes are diminished, but computational time is increased.

By constructing tables which evaluate filter response for varying parameters, and constructing computer programs for the generation of filter coefficients, digital filters for use in a variety of applications may be more readily designed.

Note:

1. Requests for further information may be directed to:
   Technology Utilization Officer
   Marshall Space Flight Center
   Code A&TS-TU
   Huntsville, Alabama 35812
   Reference: B72-10156

Patent status:

No patent action is contemplated by NASA.

Source: R. E. DeMandel and S. J. Krivo of
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