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NASA TECH BRIEF
John F. Kennedy Space Center

Digital Notch Filter

The problem:

Notch filters, i.e., band rejection filters that produce a sharp notch in the frequency response curve of a system, have several disadvantages. Even digital gate filters, the currently most accurate notch filters, are frequently subject to false resonance indications. Among the alternative filters, inductance-capacitance resonance circuits and resistance-capacitance resonance circuits tend to be unstable and electronic counters are complicated, expensive, and usually inconveniently large.

The solution:

A digital notch filter determines whether the time period of an incoming signal matches a time preset in the filter. When the signals do not match, the high or low frequency deviation reading is displayed digitally.

How it's done:

The filter consists of five parts:

(1) A pulse timing circuit that generates a pulse at the beginning of each cycle of the filter input signal, as well as several other timing pulses, including a preset timing pulse, that are sent to various logic circuits in the filter.

(2) A pulse encoder logic circuit which encodes frequency deviations for input into the pulse decoder.

(3) A pulse overlap and resonance detection circuit to detect high or low frequencies, establish the bandwidth definition of the filter, and feed logic pulses containing this information into the pulse decoder.

(4) A pulse decoder and signal output that allows only signals that fall within the filter bandpass to be fed out. Signals representing a high or low frequency are put into the frequency deviation circuit. Also included are signal lights indicating whether the frequency is high, low, or synchronized.

(5) The frequency deviation circuit provides an analog signal that is negative if the frequency is too low and positive if too high. This is used to drive an analog or digital recorder and/or indicator for readout of the degree of frequency deviation.

This filter has numerous advantages when compared to currently used filters:

(a) It is self-starting.
(b) When it is tuned to one frequency, no other frequency will produce a resonance indication.
(c) The bandwidth can be adjusted over a wide range.
(d) It has a high Q at audio and subaudio frequencies and is not affected by rf interference at its input.
(e) The filter follows the frequency variations in the input signal with great accuracy, since it can determine the frequency from only two cycles.
(f) It provides resonance indications, both visual and pulse, which have many uses.
(g) The system is simple to construct and requires no external frequency standard.
(h) It is very stable.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Kennedy Space Center
Code AD-PAT
Kennedy Space Center, Florida 32899
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Patent status:

This is the invention of a NASA employee, and U.S. Patent No. 3,566,263 has been issued to him. Inquiries concerning license for its commercial development may be addressed to the inventor: Mr. Benjamin Z. Meers, Jr., 561 Margrave St., Harriman, Tennessee 37748.

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Category 02