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NASA TECH BRIEF

Improved Phase-Shift-Keyed Detector

An improved phase-shift-keyed (PSK) detector has been developed for use in the Saturn space vehicle and Apollo telescope mount command systems. In these systems, the PSK detector is a vital link, in that it translates an analog signal from the command receiver into digital information for the command decoder. The analog PSK signal is composed of a reference frequency (f_r) and a data frequency (f_d). The reference frequency is twice the data frequency and, ideally, the two frequencies are either in phase or 180 degrees out of phase. Under many conditions, f_d may be displaced from center by signal components within the radio frequency links. The PSK detector separates the composite PSK signal and f_r, compares the phases of f_d and f_r, and furnishes a digital *one* or *zero* as a result of this comparison.

In order to separate f_r from the composite PSK signal, a passive bandpass filter has been used in prior detectors. At an f_r of 1kHz, this filter requires large inductors and capacitors and wastes significant amounts of power. The improved PSK incorporates an active filter circuit, using an operational amplifier and resistor–capacitor network. The capacitances in this network are an order of magnitude less than in the passive filter, and 1 percent resistors replace the inductors. In addition, the active filter offers the advantages of being critically tunable with a resistor; having a fairly high quality factor (Q) for good separation characteristics an octave from the tuned frequency; and providing a selectable gain, rather than a loss of signal. The detector will operate in a high-noise communications environment, with possible phase displacement of as much as ±45 degrees (±125 microseconds) over a temperature range of −55°C to +105°C. It will accept input signals varying from 0.65 to 2.25 volts rms. The operational amplifiers in an integrated circuit package provide advantages of small size and low power drain. By using these operational amplifiers with a controlled-gain, multiple-feedback, active filter network, the system exhibits high input impedance, low output impedance, and relatively high stability. These features are achieved with a minimum number of network elements.

Notes:

No additional documentation is available. Questions may be directed to:

Technology Utilization Officer
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Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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Category 01