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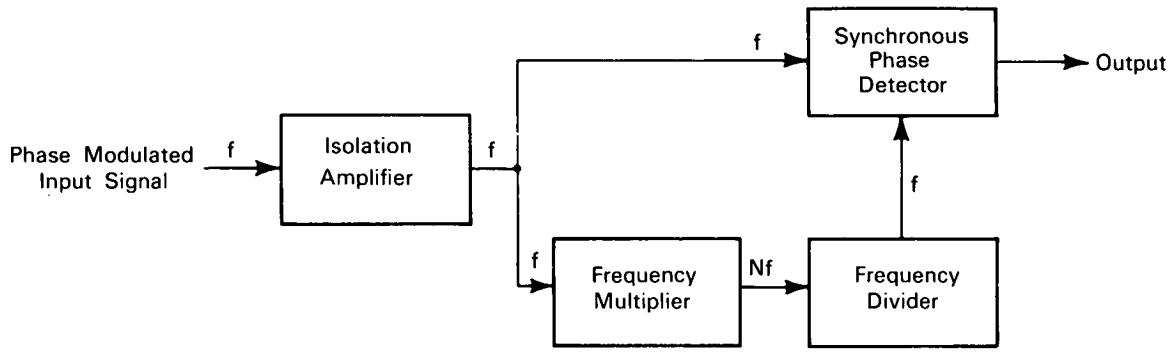
Brief 65-10080

NASA TECH BRIEF

Phase Detector Circuit Synthesizes Own Reference Signal



The problem: Detecting discrete-step, phase-modulated signals without using an external reference signal, complex internal timing circuits, or synchronized timing between the transmitter and receiver.

The solution: A phase detection circuit which synthesizes its phase reference signal from the phase-modulated input signal.

How it's done: The output of the isolation amplifier (at the input frequency f) is connected to both the frequency multiplier and the synchronous detector. The frequency multiplier uses the signal from the isolation amplifier as a control timing signal to generate an output at N times the input frequency. The multiplication factor, N, for a particular system is determined from the expression $N = 2\pi/\Delta\phi$, where $\Delta\phi$ is the phase change per step in radians. A frequency multiplier is used because phase changes in the input signal do not appear in the multiplier output.

The output of the frequency multiplier (at a frequency Nf), goes to the frequency divider, where, after division by N, a constant-phase signal of frequency f is available for use as the reference signal in the synchronous detector. The synchronous detector compares the phase of the original signal from the isolation amplifier with the phase of the synthesized reference signal. The output of the detector is a dc voltage, the polarity of which changes each time the input signal changes phase.

Notes:

1. It is necessary that the pulse rate and the carrier of the transmitted signal (e.g., from a telemeter) be synchronized so that the phase change (from modulation) always occurs at the same point on the carrier wave shape.
2. In a bi-phase modulation system, where digital information is transmitted in steps of 180° phase difference ($\Delta\phi = \pi$), the multiplication factor, N, is equal to 2.
3. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama, 35812
   Reference: B65-10080

(continued overleaf)

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

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