

# NASA TECH BRIEF

## Goddard Space Flight Center



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### Synchronized Frequency Transposer

#### The problem:

A number of techniques are used to compress or expand the time bases of analog signals. These techniques, however, involve expensive and complex circuits which are not suited for low-cost consumer applications.

#### The solution:

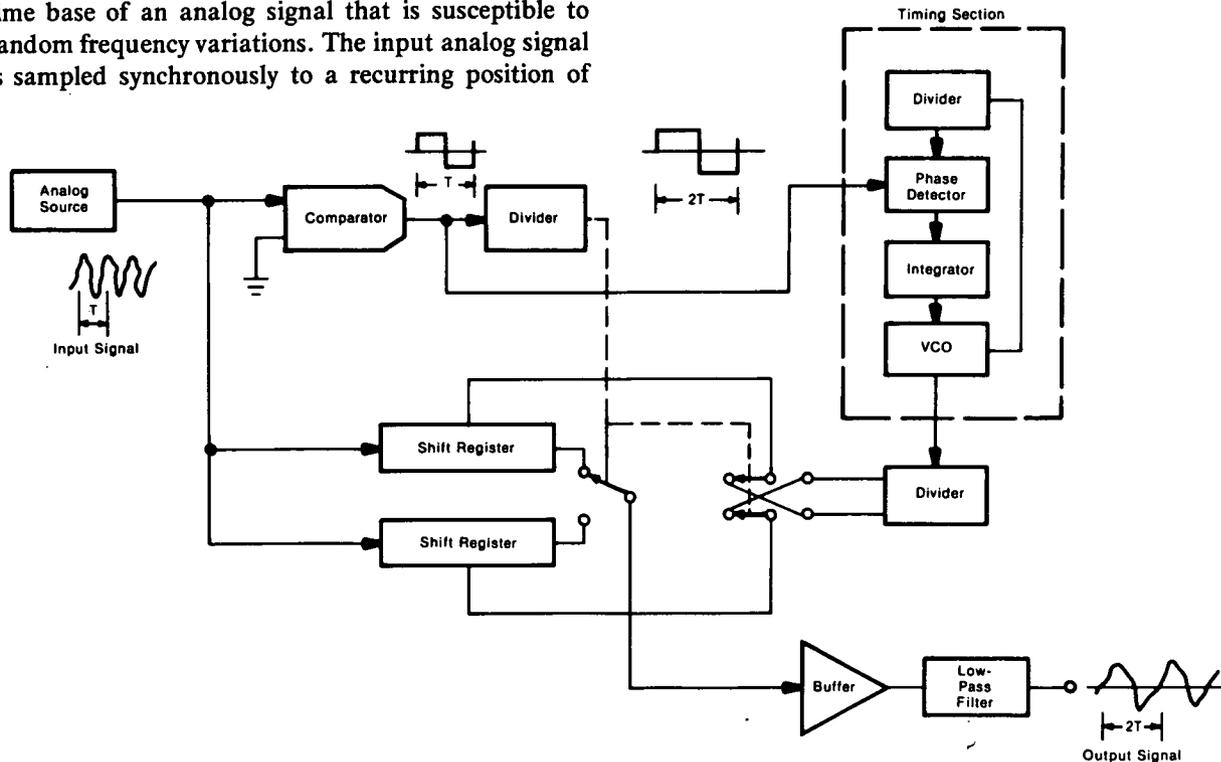
An inexpensive frequency transposer has been developed which operates entirely in the analog domain.

#### How it's done:

The transposer is made to compress or expand the time base of an analog signal that is susceptible to random frequency variations. The input analog signal is sampled synchronously to a recurring position of

the signal, the zero crossover points. These samples are serially loaded into an analog shift register at one rate and are unloaded at a different rate, resulting in the time base expansion or compression. The analog shift registers are commercially available charge-coupled shift registers (CCSR).

As shown in the illustration, an input analog signal is fed simultaneously to a comparator (zero crossover circuit) and two analog shift registers. The signal is sampled and serially stored in the registers. The synchronization of sampling-to-source is provided by the timing section. This section is responsive to the zero crossover circuit to provide first and second timing signals to the storage section.



Synchronized Frequency Transposer

(continued overleaf)

In operation, the input analog signal is serially loaded into one of the analog registers at a rate determined by a voltage-controlled oscillator (VCO). At the same time, the signal is serially unloaded from the other register at an expanded time rate determined by the divider output feeding through a switch. Two switches synchronized with the zero crossover points of the input signal are used to alternate the loading and unloading of the registers. When the circuit is used as a time base compressor, the registers include recirculation feedback paths for waveform repetition.

**Patent status**

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

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