NASA TECH BRIEF

Ames Research Center

Fast Signal Averager

The problem:

To increase the signal-to-noise ratio of weak repetitive electrical signals.

The solution:

A device which yields a waveform that is the average of a number of the repetitive electrical signals.

How it's done:

The electron beam of a cathode ray tube with a fast phosphor is intensity-modulated by the input signal so as to produce a repetitive horizontal trace of luminous intensity proportional to the time-varying signal strength. The horizontal trace of the cathode ray tube is made to occur at such a rate that the repetitive portion of the signal of interest (plus noise) is encompassed within its length. If the repetitive rate of the electrical signal is asynchronous, the signal is made to trigger the trace. The traces are imaged by a lens onto the sensitive surface of a Vidicon tube; after the input signal has been exhibited a given number of times on the cathode ray tube, each point on the sensitive surface of the Vidicon tube will have stored a charge that is proportional to the total amount of light that has fallen on it. When an electron beam within the Vidicon is made to scan horizontally across the face, the current carried by the beam discharges the sensitive surface and is proportional to the amount of light that has fallen on each sensitive spot. Thus, the electron beam amplitude at each point in the Vidicon scan represents the algebraic average of the corresponding signal strengths. The waveform of the Vidicon scan manifests a greater signal-to-noise ratio than any of the individual traces registered on the cathode ray tube face because the signals are always of the same sign while the noise is sometimes positive and sometimes negative.

The signal-to-noise ratio is increased in proportion to the square root of the number of scans of the cathode ray tube per scan of the Vidicon. As an example, for 100 cathode ray tube scans, the output of the Vidicon provides a signal-to-noise ratio enhanced by a factor of 10.

Note:

No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
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Reference: B74-10109

Patent status:

Title to this invention, covered by U.S. patent No. 3,582,775, has been waived under the provisions of the National Aeronautics and Space Act [42 U.S.C. 2457 (f)] to the Stanford Research Institute, Menlo Park, California 94025.

Source: Tom N. Cornsweet of
Stanford Research Institute
under contract to
Ames Research Center
(ARC-10090)

Category 02