

NASA TECH BRIEF

Marshall Space Flight Center



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Automatic Quadrature Control and Measuring System

The problem:

Quadrature input signals cause errors in the outputs of instrumentation systems utilizing reactance transducers for measuring such parameters as pressure, displacement, liquid level, and fluid density. These errors, which cause loss of resolution, high power drain, and poor reliability, occur because of the heat generated in servo motors in servo control systems.

The solution:

Quadrature signals may be controlled by an automatic quadrature control and measuring system. The system includes a solid state phase detector, a phase shifter, a signal amplifier, a dc amplifier, and a control network. As shown in Figures 1 and 2, the signal amplifier may be an existing part of the instrumentation system, or it may be added as part of the control system.

How it's done:

The operation of the automatic quadrature control and measuring system (see Figures 1 and 2) is as follows: The transducer generates unwanted quadrature signals

as well as the desired output signals. Both signals are amplified together in the signal amplifier. At the output of the signal amplifier the quadrature signal is separated from the total signal by use of the phase detector, with the phase shifter providing the appropriate reference. The output of the phase detector is further amplified and filtered by the dc amplifier. The output of the dc amplifier provides the appropriate signal to neutralize the quadrature component of the signal from the transducer.

Performance data show the system capable of automatically neutralizing quadrature components in excess of 10 times the full scale in-phase signal to a level more than 45 dB below the full scale in-phase signal.

In previous instrumentation systems and control systems, the effects of quadrature signals have been handled in various ways. These include for example: accepting the errors due to quadrature, compromising other parameters to achieve a system insensitive to quadrature signals, hermetic sealing of sensitive parts,

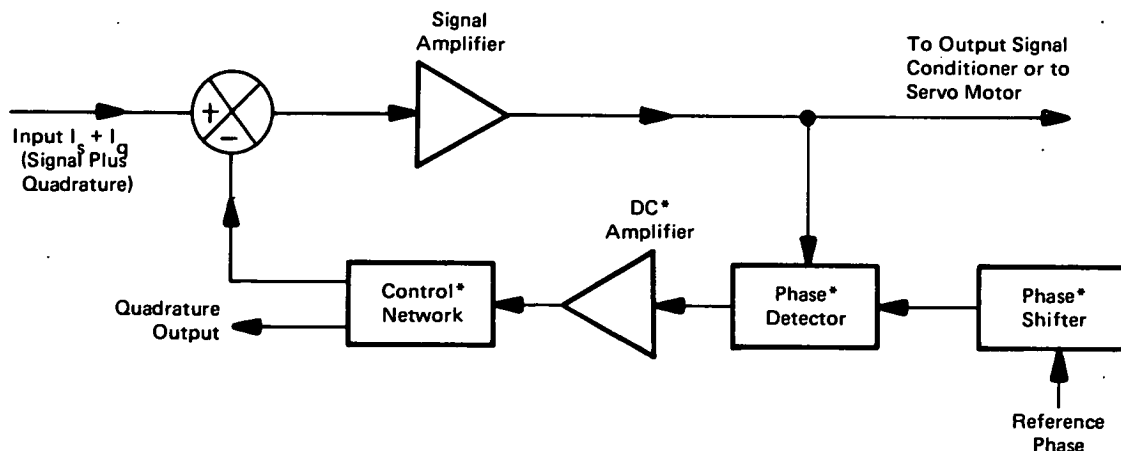


Figure 1 Signal Amplifier Is Part Of Existing System.
*Denotes Items Added to Form Quadrature Control System

(continued overleaf)

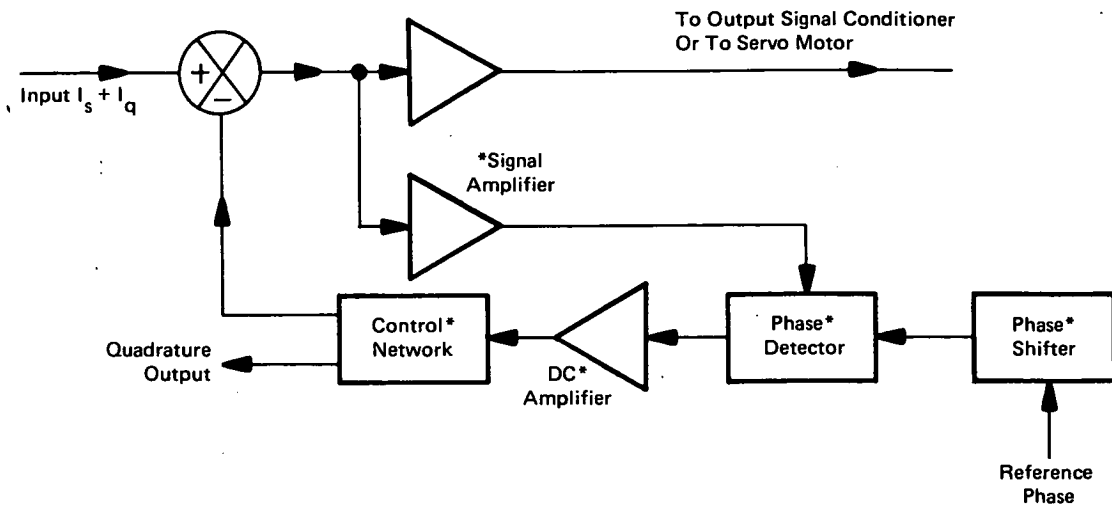


Figure 2 Signal Amplifier Is Not Part of Existing System.
 *Denotes Items Added to Form Quadrature Control System

or gating out quadrature signals by using phase detectors and switching networks.

In this system the best transducer for a given application can be chosen without worrying about the effects of quadrature signals. Since quadrature heat effects are no longer present, hermetic sealing is not required. Amplifier saturation is avoided by removing the quadrature signal at low-level stages before amplification. Furthermore, added distortion and inaccurate readout, both problems in switching networks used for quadrature control, are not present in this system.

Notes:

1. This innovation may be of interest to designers and manufacturers of instruments and servo control systems.

2. No further information is available. Specific questions, however, may be directed to:

Technology Utilization Officer
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Patent status:

Inquiries concerning rights for the commercial use of this system should be addressed to:

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 (MFS-21660)