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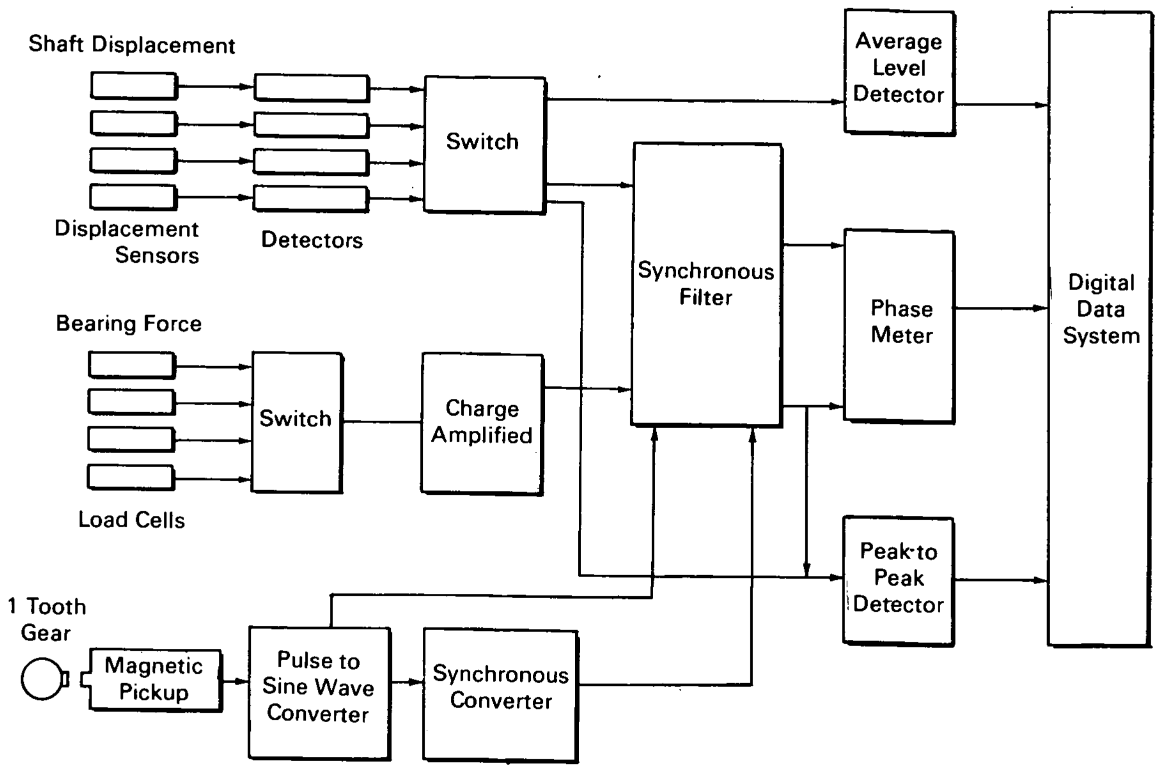
NASA TECH BRIEF

New Data Acquisition System Records Bearing Measurements Directly



A digital data acquisition system has been developed that facilitates the recording of steady state and dynamic data of bearing and shaft displacement.

Conventionally, signals from the displacement sensors in the test apparatus are displayed on oscilloscopes; the displays are photographed, and displacement measurements are made by hand from the photographs. Alternatively, the signals are recorded on a multichannel tape recorder, and either played back on an oscilloscope and photographed, or printed out permanently on a high-response strip recorder. These methods require a considerable amount of time and manual labor to obtain digital data. The new acquisition system records the measurements directly in digital form in such a way that the elliptical orbits formed can be reconstructed and the data can be reduced automatically.

As shown in the figure, readings are obtained by the digital data acquisition system from displacement sensors and load cells. To read the equilibrium posi-

(continued overleaf)

tion of the test shaft, signals from the displacement sensors are switched to the average-level detector and then into the readout portion of the digital data acquisition system. The average-level detector receives the sinusoidal signal from the displacement sensor and electronically measures the absolute distance from a zero reference point to a reading midway between the peak and trough on the sine wave.

To obtain the orbit size of a particular test point, displacement sensor signals are switched to the peak-to-peak detector and then on to the digital data acquisition system. The peak-to-peak detector electronically measures the distance between the peak and the trough of the sinusoidal wave set up by the displacement sensor.

The dynamic forces can be read by a series of programmed switches which send the load cell signals through a charge amplifier, through one channel of a synchronous filter and through the peak-to-peak detector. The synchronous filter is dual-channelled and is automatically set to the frequency corresponding to the rotative speed of the test. In order to obtain the phase angles between the unbalance force and either a displacement or a force, a phase meter is connected to the digital data acquisition system. A single-tooth gear on the test shaft actuates a magnetic pickup once each revolution, and this pulse is converted into a sine wave in a pulse-to-sine converter. The converter causes the synchronous filter to operate at the rotative speed of the test shaft. The signal from the pulse-to-sine converter goes through one channel of the synchronous filter and into one channel of the phase meter. Either a displacement or a force signal enters the second channel of the synchronous filter and the second channel of the phase meter. Thus, the phase meter reads the angle of any displacement or force signal with respect to the unbalance of the test bearing shaft, and sends the signal to the digital data acquisition system.

Notes:

1. In addition to the dynamic measurements, pressures, temperatures, flows, torque, and steady load are read by the digital data acquisition system during any one scan of the data.
2. The system can handle 600 pairs of leads and can read instruments at the rate of three per second. Readouts can be obtained in the form of punched and/or printed tape.
3. No additional documentation is available. Specific questions, however, may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B70-10503

Patent status:

No patent action is contemplated by NASA.

Source: R.J. Rossbach of
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