APPLICATION NOTE

Endurance Test in Automobile: Monitoring of Flexible Joint Boots

Real-Time Data Acquisition Synchronized to Rotational Position

CAS DataLoggers provided the data acquisition and control solution for an automotive supply company conducting an endurance test in automobiles for flexible joint boots. As part of the normal engineering process, it was often necessary to measure the reliability of mechanical assemblies over long periods of time under various stress conditions. This required that data on the assembly line be recorded and that wear-out or failure mechanisms undergo routine evaluation. In the case of flexible joints on shafts, the parts were rotated at high speeds over an extended period of time to simulate the typical operating life. The failure modes included deformation and cracking of the rubber boots, for which periodic manual observation was the only method for identifying failures. However, it was impractical to continuously record video and difficult to capture images of a part spinning at up to 10,000 RPM, so plant management realized the need for a sophisticated data acquisition and control device with an advanced DSP that could operate in real-time and included user-friendly software.

Installation

The customer installed an ADwin-Light-16 data acquisition and control system adjacent to its assembly line. Subsequently, a system incorporating the ADwin device was designed that allowed unattended monitoring of the rubber joint boots over extended periods of time. The ADwin-Light-16 was used to measure the rotational speed of the part via a reflective optical sensor providing a TTL pulse for every shaft revolution. Next, the ADwin system calculated the delay required to achieve an absolute offset (measured in degrees) which was used to make the part appear to be motionless using an externally triggered high-speed strobe light providing up to 10,000 flashes per minute. The ADwin system then calculated a phase delay that, when used in conjunction with the strobe, would make the part appear to rotate at a much slower RPM, typically in the range of 1-10 RPM.

Additionally, the ADwin-Light-16 was used to trigger a Sony camera providing 30 frames a second at a 640 x 480 bit resolution which captured a sequence of images that in turn captured a full 360-degree view of the part being tested. A Matrox frame grabber was integrated to capture images from the camera for processing, while a program written in Visual Basic was used to set-up the capture parameters, schedule the periodic collection of the images, and store the images in a sequence of files on disk, compressing the images to minimize storage requirements.

Usage

An economical 8-channel intelligent real-time data acquisition system, the ADwin system featured 8 16-Bit, 10 µs ADC analog inputs and 6 TTL/CMOS compatible digital inputs as well as 2 16-bit analog outputs and 6 TTL/CMOS compatible digital outputs. 2 32-Bit counters and a TTL/CMOS compatible trigger input were also standard, with an option to add an up/down counter. The system featured a local 32-Bit SHARC DSP with its own local memory to handle system management, data acquisition, on-line processing and control of outputs, and the ADwin-Light-16 itself was available in many configurations including PCI, CompactPCI, and EURO USB configurations or external USB or Ethernet.

The ADbasic real-time development software was used to define the processing sequences executed on the hardware. Using ADbasic, engineers optimized and compiled the program code with just a mouse-click. After being loaded on the system by ADbasic or a graphical PC user interface, the real-time processes executed independently. ADbasic contained the functions to access all inputs and outputs as well as functions for floating-point operations, process control and communication with a PC. A library was provided which contained standard functions such as filtering, various examples for counter use, closed-loop controllers, function generators, etc. which lead to a faster program implementation.

Additionally, by means of the easily configurable ADtools, users could display their real-time data graphically or numerically, to visualize process sequencings or to set input values via potentiometers, sliders or push buttons. ADtools also provided users with the current status of the ADwin's system resources. The ADwin software environment could be used under Windows and Linux, or as a stand-alone data acquisition system. Also, ADwin contained drivers for many of the popular programming environments including Visual Basic, Visual C/C++, LabVIEW/LabWindows, TestPoint, MATlab and Simulink.

Benefits

The automotive supply company benefited in several ways following installation of the ADwin data acquisition and control system. The ADwin system was an ideal, low-priced solution for fast data acquisition and control in real time under Windows. By using an automated system, the need to have a person manually inspect the boot for failures was entirely eliminated--instead, the history of the complete test was recorded in a sequence of files that was played back later for analysis. By freezing the motion of the part, the joint boot could be inspected without stopping the test and individual sites could be inspected for degradation. The system allowed images to be captured to a precision of ½ degree of rotation while the test article was rotating at 10,000 RPM. Also, with the system's onboard SHARC DSP, processing of each measurement occurred immediately after acquisition. The ADbasic environment allowed operators to program mathematical operations and functions which were executed immediately after each sampling step, even at sampling rates as high as 100 kHz.

For further information on ADwin data acquisition and control systems, endurance test in automobile or to find the ideal solution for your application-specific needs, contact a CAS DataLogger Application Specialist at **(800) 956-4437** or www.DataLoggerInc.com.