The Stress of a Turn

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NI Products Used:
LabVIEW 2012
cDAQ-9174
NI-9205
NI-9401
NI-9236
NI-9213
NI-9481

Category:
Machine Control
Structural and Physical Test and Monitoring

The Challenge
To create a new test station that would automate and record data for the testing of prototype and production steering assemblies to ensure the longevity of a key component of the new product.

The Solution
Create a new test station using LabVIEW that automates motion control and data collection migrating from the prior hydraulic valving method used along with hand written data.

Introduction
Data Science Automation (DSA) is a premier National Instruments (NI) Alliance Partner that specializes in automating and educating the world leading companies. Clients choose DSA because of DSA's deep knowledge of National Instruments products, disciplined project development process, its staff of skilled Certified LabVIEW Architects and Certified Professional Instructors, and its unique focus on empowerment through education and co-development. DSA has long been the leader in mechanical life testing, working with manufacturers of critical structural components for complex engineered systems.

Background
During the development of a new floor cleaner the manufacturing team needed to test the new designs for their steering column assembles. The new steering columns needed to be tested to verify their ability to withstand the normal forces the column would be subjected to throughout its expected lifespan. This testing would be done in two phases - during the design phase and during the subsystem manufacturing phase. This would help the manufacture handle any issues before the parts were installed in the new product. The fixture would also go be used as a quality test system once the units were in full production to help maintain the level of quality needed to ensure that the product would not fail during operation.

Approach
The older method of testing these type of parts was controlled using hydraulic cylinders and timers that would need to be manually set for each test. The data was collected periodically by an employee only on a daily bases. This sporadic testing made it difficult to quickly spot trending toward an impending possible failure until after the part had actually failed. Using the new test system (Figure 1) the operator can review the collected data trend by just looking at the screen and observing the condition of the latest data. This data was also recorded at a much faster interval than the manual

recording of data. This resulted in more insight into the failure process than the older method. The new system used two cDAQ 9174 chassis along with NI 9401 cards to provide eight counters to control four test stations. Each of the test stations was able to be controlled independently. The operator could also view all of the data for all four of the test stations on a single screen (Figure 2) allowing them to make a quick assessment of the condition of the parts and rapidly identify if the stresses were trending in a pattern of known failures. The LabVIEW software controlled the motor direction and the degree of turn needed for the testing of the components. The system allowed the operator to set the percentage of the full rotation and the ratio of full turns to partial turns. This was to more accurately represent the range of stresses that would be applied to the components as the floor cleaner was used in a real world environment. The system would monitor and record the temperature of the power steering motor to insure that it was not overheating during the course of the testing. All strain gages were also monitored and recorded to make sure that the forces on the components stayed within the test parameters that would be entered at the start of the test. The RPM of the shaft rotation was also monitored as additional parameter required to be controlled.

Benefits

The new system made it easier for the operator to enter the various set points that determined the operating conditions and simplified adjustments while the test was in progress. The operator could pause the test to check components for visual wear if the data showed an early trend toward failure. This would allow the design team to make necessary adjustments before the test was completed without losing the data already collected.

A secondary benefit of the new system was that it would help keep the facility cleaner by reducing the amount of hydraulic fluid used in the test fixture. The older test system would leak hydraulic fluid from the main actuators which contained large amounts of the fluid. By reducing the amount of hydraulic fluid used also helped to make it a greener facility.

This automated test system was powered by LabVIEW and NI hardware to achieve a better overall test solution. It provided better insight into design flaws and quality deficiencies prior to full production. The system plays a major role in the client's quest to provide higher quality products for their customers.

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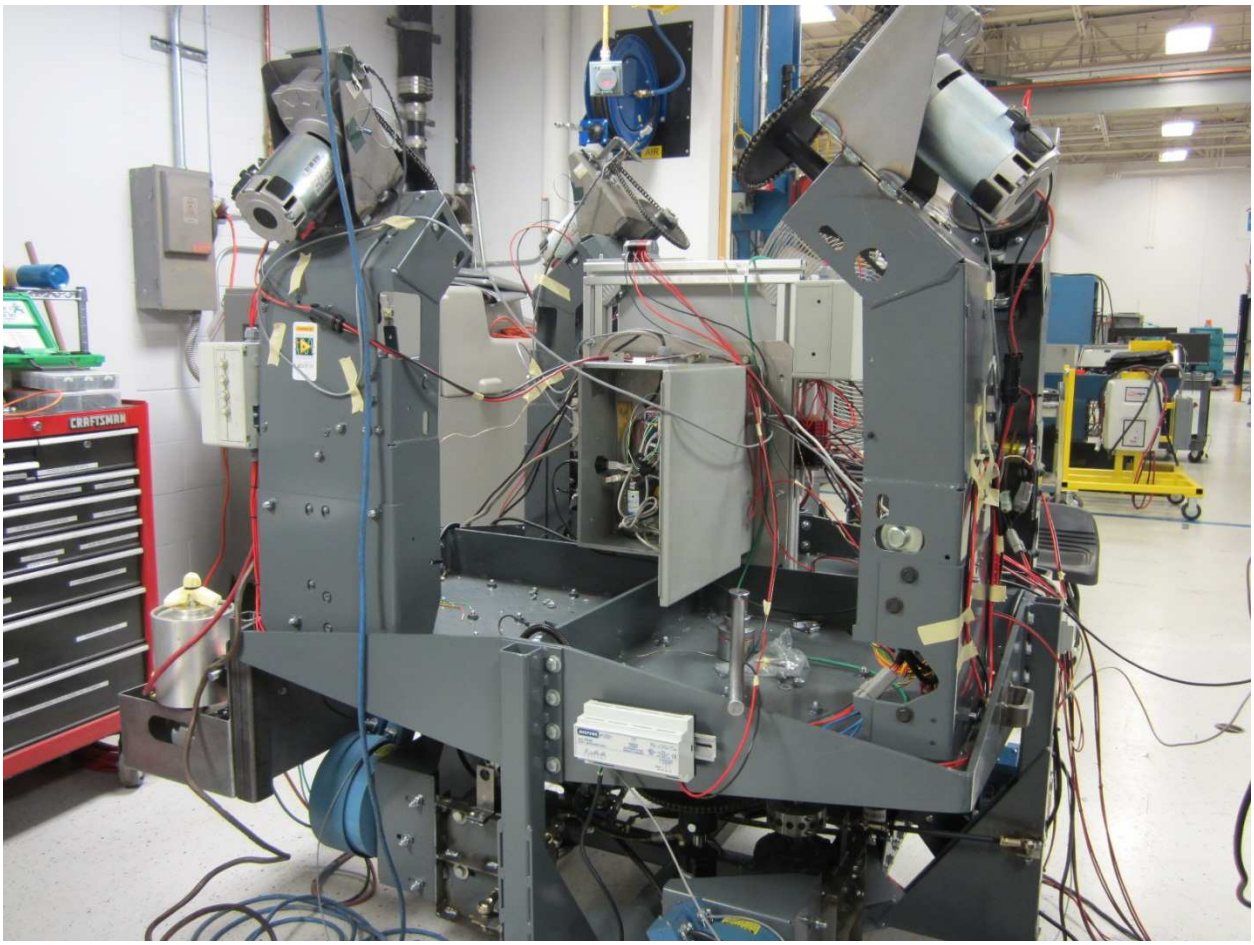

Figure 1. The New Test System during Initial Installation and Checkout

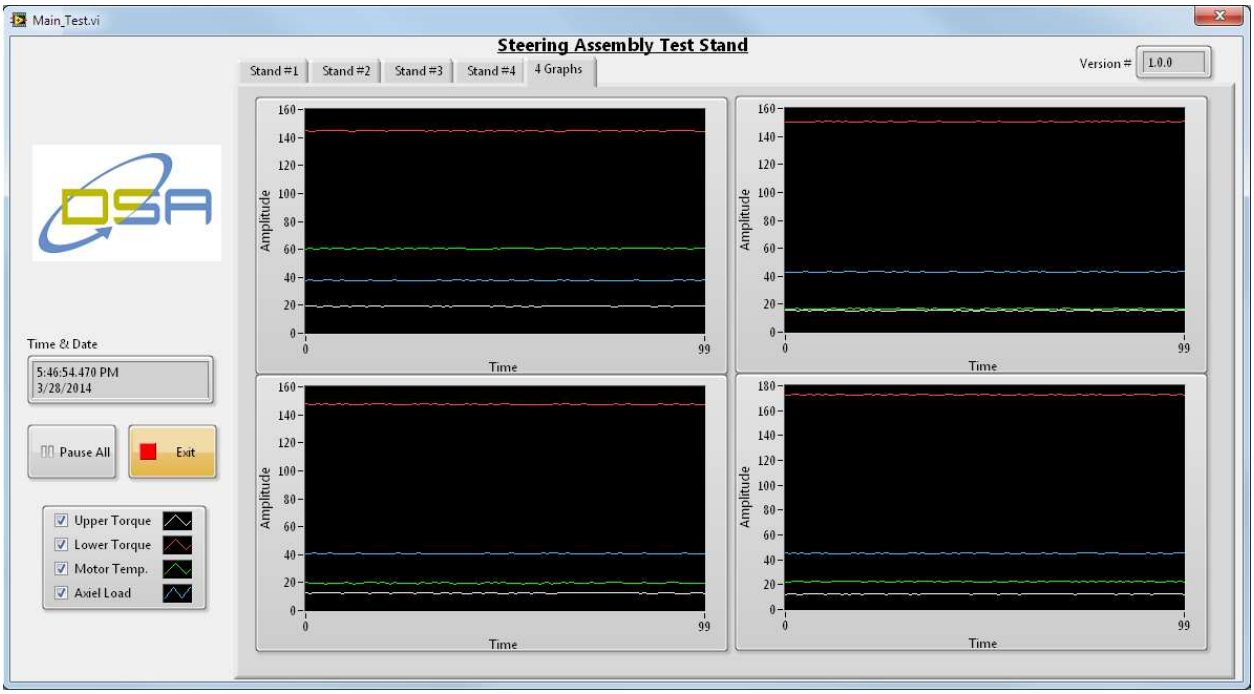

Figure 2. View of Four Station Graph Display