Capacitance Sensors Offer Advantages for Thread Inspection Applications

Introduction

Many manufacturers today, especially suppliers to the automotive industry, insist on 100% inspection of the quality of internal threads on critical parts and components. This reduces the probability of adding future "value" to a part that, in the end, may need to be scrapped. In addition, improperly tapped holes must not reach consumers to avoid warranty concerns, assure customer satisfaction and reduce potential liability. Proper inspection can also pinpoint optimal tool change intervals, saving thousands of dollars per year. The following paper outlines the use of capacitance sensors and their advantage over screw and eddy current systems.

The Problem

Manual inspection is slow, not always reliable and tedious for the inspector. Because of this manufacturers have struggled to come up with ways to reliably automate the process at a reasonable cost. Automated systems are available that use "screw sensors" which consist of a motorized stage that monitors torque as a test piece is screwed into a bore hole. An abnormally high torque value indicates a crossed thread, an insufficient thread depth or possible debris in the hole. Low torque may indicate missing threads and/or a larger than desired hole diameter. Unfortunately the test screw can quickly wear or be cross threaded, requiring operator attention and a tooling change. Additionally, the motorized torque stage is not cheap, often putting the price tag beyond reach for typical applications. And finally, a worn screw can provide false rejections leading to the unnecessary scrapping of parts.

Eddy current systems can also be automated. Their output is compared to the signature of a stored "ideal master" as the probe is stroked in and out of the hole being inspected. If the signatures match within preset limits the parts are accepted, otherwise they fail. Unfortunately eddy current technology relies on the magnetic properties of the material being measured and if fluctuations occur the accuracy can be affected. In addition, for proper operation, eddy current probes should be calibrated to the specific material being measured for optimal performance, which is not always easily accomplished.

MTI Instruments, Inc.
325 Washington Avenue Extension
Albany, NY 12205
PH: +1-518-218-2550
OR USA TOLL FREE: 1-800-342-2203
FX: +1-518-218-2506
sales@mtiinstruments.com
www.mtiinstruments.com

The Solution

Capacitance solutions are a cost effective alternative which are becoming increasingly popular due to their high reliability and fast measurement speed. Special cylindrical “ring probe” designs consist of a passive sensor with radial sensing element around the probe diameter. The diameter and height of the sensing element is customized to match the required thread diameter and pitch. Similar to eddy current sensors, the probes measure in the radial direction as they are stroked in and out of a hole. MTII’s Accumeasure capacitance amplifiers convert the capacitance between the probe and the thread to a precise voltage. This voltage signal is compared to that of an ideal thread profile within MTII’s customized software and monitoring system. Limits are set within the software to provide alarm indications for abnormal threads or diameters.

Conclusion

Each of the above mentioned systems require fairly precise alignment of the sensor to the hole being inspected. They also require a “Z” motion stage to stroke the sensor in and out of the hole. Accumeasure capacitance sensors offer a ruggedized solution because of the passive probe design which also provides additional stability and repeatability over active eddy current systems. Sensors are often constructed of hardened tool steel for added protection should contact with the part occur. Contact MTII for assistance with your application.

mtiinstruments

sales@mtiinstruments.com • www.mtiinstruments.com