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MsT360 Guided Wave Sensor: A Novel Omnidirectional Transducer

Omnidirectional sensors inspect large areas of plates from a single location, but determining precisely where a feature is located can be challenging. Conversely, directed sensors can precisely locate an indication but have no sensitivity to flaws away from the wave propagation direction.

Southwest Research Institute® (SwRI®) has developed the MsT360 omnidirectional guided wave probe based on magnetostrictive transducer (MsT) technology that combines the best of both sensor types to create a novel omnidirectional transducer.

The MsT360 includes a plate MsT probe connected to a software-driven servo motor that rotates the probe over the tank wall. Acoustic efficiency comes from a shear-wave couplant. The fundamental torsional T(0,1) mode is used due to its low dispersion rate, which allows high accuracy in defect location. The probe can be attached to a tank wall using magnets or suction cups.

Testing includes mounting the probe, running an automated scan, and compiling an inspection report. More accurate results can be obtained by using two probes that cover dead zones and confirms relevant indications.

MsT360 Omni Guided Wave Scan Settings

- Standard frequencies of 20-250 kHz
- High-frequency package includes frequencies from 250-500 kHz
- Up to three frequencies can be acquired at a time
- Probe rotated in 0.2 to 5.0 degree increments
- Transversal or compressional modes of guided waves
- With five degree increments, the time needed for one scan is reduced to about 10 minutes

The area of probe coverage could be in the 10-100 square meters range, depending on the geometry and condition of the structure.

A synthetic aperture focusing (SAFT) algorithm is used to process data.

Due to wide frequency range, the probe can be used on plates with thicknesses up to 30 mm. Field tests indicate that guided waves penetrate tank walls with different plate thicknesses and bends. Additionally, custom versions of the probe could be used for structural health monitoring (SHM) of shells with a temperatures up to 250°C. These probes utilize a dry coupling method and high temperature materials.

A MsT 360 probe

B 15.6 mm wall to 9.3 mm wall 16% wall loss area
360 degree scan

C 10% wall loss areas 16% wall loss area
35% wall loss area
Branch pipes
Weld 1
Weld 2
Weld 3
Supports
6 meters
Signal to noise ratio, (dB)

Automated scan using MsT360: A - probe mounting; B - automated scan process; C - B-scan imaging of acquired data with suspect indications



MsT360 omnidirectional guided wave probe mounted on storage tank wall.

We welcome your inquiries.
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