Inspection of pipes using Guided Waves: state of the art

A. Demma
• GW basics
• Opportunities
• Limitations
• Latest developments
• Conclusions
Reflection from a Feature
(such as corrosion)

When the guided wave hits a change in cross section (or impedance), it reflects back toward the transducer.
Cross Section Change

The dark grey Section represents the Cross-sectional area.
System Components

- Wavemaker G3
- Lemo Cables
- Transducers Ring
Corrosion is indicated by large red component.
Guided Waves (unrolled pipe view)
Why Guided Waves?

- 100% volumetric coverage
- Rapid screening
- In Service inspection
- Significantly reduced access costs
100% Volumetric coverage

Example:
10” pipe, 12m length with 2 simple supports

Standard UT = 0.027% area coverage
Guided Wave ~ 100% area coverage
UT check after GW inspection
Rapid screening

• Acts as filter: point out areas where more attention is needed
In-service inspection

- Temperature
- Product
- Pump noise, product flow
Reduced access costs

Think of costs for:

- Scaffolding
- Removing insulation
- Digging
- Operating underwater
Standard pipe testing applications
Pipe racks are generally straightforward to test. Very long ranges can be obtained.
Insulated pipes - Limit removal insulation
Sleeved Road crossings-Test from accessible location

Only external access is required.
Wall penetrations - Test from accessible location

Only external access is required.
Overhead pipes - long range screening from accessible location

Only limited access needed, can reduce/remove the need for scaffolding
Riser - Full splash zone screening
Long range screening

Location of testing equipment

Location of Defects which were detected
Earth wall

Location of defects which were detected

Defect detail

Location of testing equipment
River Crossing
Corrosion under supports detected without direct access
Buried pipes
Limitation of guided waves in pipe testing applications
Range

- 5-150 meters depending on local conditions
- Factors affecting range
  - geometry
  - general pipe conditions
  - material inside pipe
  - embedding material
Difficult geometry

- Only test through one bend in each direction
- Flanges and Ts represent the end of the test
- In general complex piping will be more difficult to inspect
General condition of pipe

Clean Pipe

Generally Corroded Pipe
Effect of Pipe Contents

- **Gases** - no effect

- **Liquids**
  - Almost no effect on the torsional mode

- **Sludge**
  - Heavy viscous deposits in the pipe attenuate the signal and reduce the test range
Attenuative Wrappings

- Bitumen
- Polyethylene
- Factory applied insulation
Case study
• Sleeved Road crossing
• Pipe does not have any built-in support
Sleeved Road Crossing
Sleeved Road Crossing

Call  Weld
Sleeved Road Crossing

Wall Loss
Latest advances
New Monitoring gPIMS
High temperature inspection
Conclusion

- GW offers very good solution to many inspection problems
- Limitations of the method shall be taken into account
- G4 - new guided wave testing platform