CIVA N·D·E 11

Simulation Software for Non-Destructive Testing

Application Example N°11

Optimize and analyse guided wave inspections

Background

Guided wave testing makes it possible to inspect structures **over long distances**, even if a part of the structure is **inaccessible**. This method relies on:

- the selection of one or several wave modes,
- the emission of these wave modes,
- the flaw-incident wave mode interaction, and the conversion into different modes,
- the analysis of the echoes received.

A good knowledge of these parameters allows the optimization of the detection of flaws over a long length of pipe.

Benefits

Civa simulation can perform a fast evaluation of the phenomena in a plate or a tube, even coated, with 3 modules:

- the display of **dispersion curves** and **modal displacements**,
- the **computation of the beam** radiated by the probe,
- the prediction of the **signal** received for a planar perpendicular flaw.

The probe setting is easily optimized with CIVA, in particular phased arrays probes can be optimized to focus the guided waves and to increase the inspection length or to increase the sensitivity to flaws.

Optimize and analyse guided waves inspections

Case study

Inspect a coated pipe that is partially accessible

THE PROBLEM

A coated pipe crossing a highway can only be inspected from the parts located on the roadside. The inspection however, must deal with the whole circumference of the pipe along its entire length.

Some crucial points are:

- the selected guided mode should be sensitive to particular kinds of flaws,
- it should **reach** the zone to be inspected,
- the analysis of the signals should **reveal** the presence of **flaws** and help to size them as much as possible.

CIVA'S CONTRIBUTION

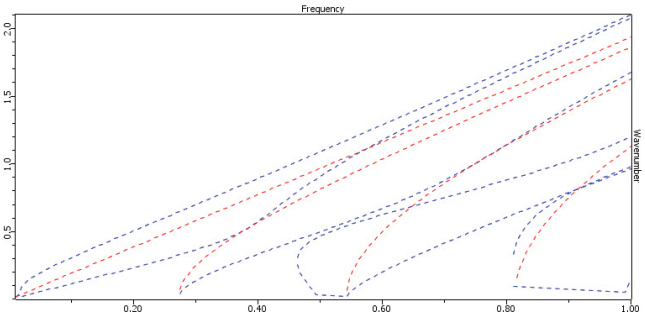
CIVA gathers all the elements necessary for the design of the inspection method and analysis of the results.

The dispersion curves displayed by CIVA help to determine the modes that propagate into the structure and to **choose the most adapted** for the inspection depending on the frequency.

Beam computations with different probes, settings or types of solicitations help to **optimize** the **mode selection** and the **directivity** of the beam.

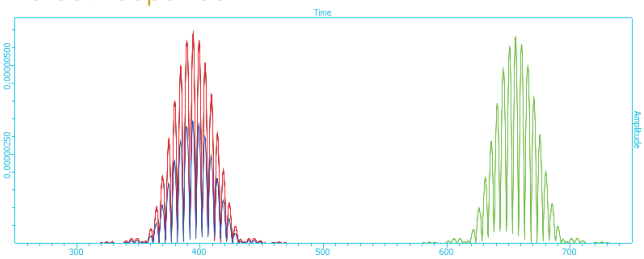
The defect response simulation helps to **quantify the amplitudes** of the echoes generated by the flaw and to **understand their origins.**

Dispersion curves

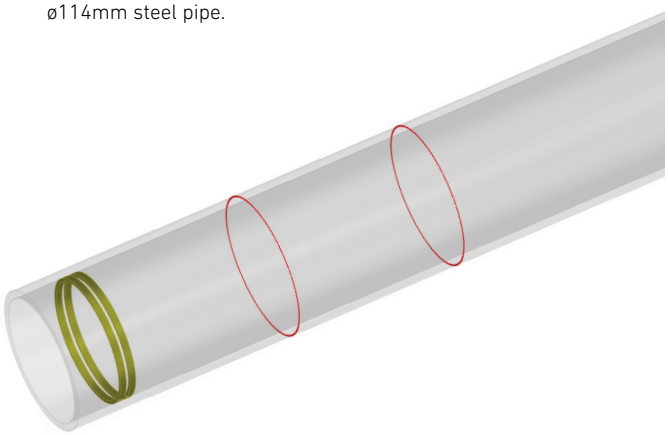


Longitudinal and torsional modes in a ø114mm steel pipe.

Defect response



Signal received for 0.5mm defect at 400mm, or a 1mm defect at 400 or 800mm, away from a dual encircled probe at 100kHz in a ø114mm steel pipe.



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