



**CIVA**  
N·D·E | 11

Simulation Software for Non-Destructive Testing

Application Example N°12

# Assess complex phenomena in a UT inspection

## Background

The **analysis** of ultrasonic signals received during the inspection of a specimen is often **complex**.

Many phenomena may occur:

- Flaws hidden by adjacent flaws.
- Successive rebounds on several flaws.
- Critical phenomena like Rayleigh waves or creeping waves propagating along the surface of the specimen or the flaws.
- Echoes received at the interface between two materials potentially hiding an indication of a flaw.

Yet to ensure safety, the **identification and characterization** of the indications must be as **precise and reliable** as possible.

## Benefits

The **CIVA ATHENA 2D module** introduces in the CIVA simulation platform a coupling with a 2D Finite Element method. It makes it possible to take into account even more phenomena occurring during the beam/flaw interaction, and thus to evaluate in more depth, specifically with the most **complex configurations**.

In addition, this module enables the visualization of **the ultrasonic beam propagation** and its interaction with one or several flaws, greatly facilitating the understanding of the phenomena involved.

Thanks to CIVA simulation, you can thus assess even the **most complex phenomena**, and take into account the critical configurations in your diagnosis.

**EXTEN·D·E**  
**CIVA**

License



[www.extende.com](http://www.extende.com)

# Assess complex phenomena in a UT inspection

## Case study

### Justify signals linked to very complex paths and phenomena

#### THE PROBLEM

The inspection of some pipes requires an advanced expertise, specifically around **networks of cracks** or **branched cracks**.

In these two cases, the interactions between flaws and the ultrasonic beam generate echoes associated with very complex phenomena, which are not taken into account by CIVA UT yet, but are in the CIVA ATHENA 2D module:

- Cracks hiding adjacent cracks.
- Echoes generated by the interaction between several cracks.
- Modes of Surface waves propagating along the edge of a flaw.

The interpretation is delicate and requires a strong knowledge of the phenomena that may influence ultrasound propagation.

#### CIVA'S CONTRIBUTION

With the new CIVA ATHENA 2D module, the assessment of very complex echoes is easier:

- Every ultrasonic 2D path is taken into account.
- **Visualization of the beam propagation** and of the interactions with the flaws or the surface of the specimen.
- Conventional representations of CIVA UT are also available (A-scans, B-scans and reconstructed view of the inspected specimen).

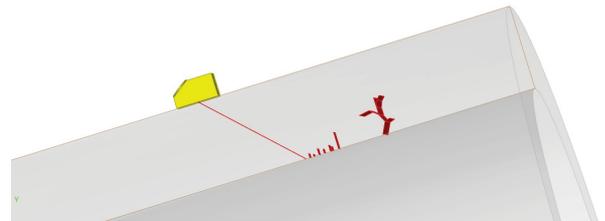


Figure 1: Network of cracks and branched cracks in a pipe.

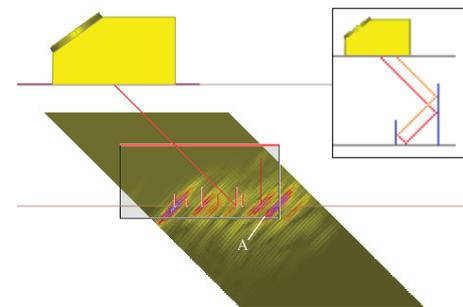


Figure 2: B-scan obtained through the inspection of a network of cracks: Echo A is not associated with an additional indication but with multiple rebounds (c.f. insert).

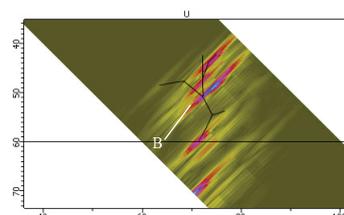


Figure 3: B-scan on a branched flaw: Echo B associated with a creeping wave on the edge of the crack.

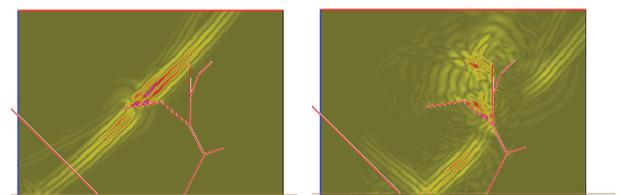


Figure 4: Propagation of the beam around a flaw.

[www.extende.com](http://www.extende.com)