

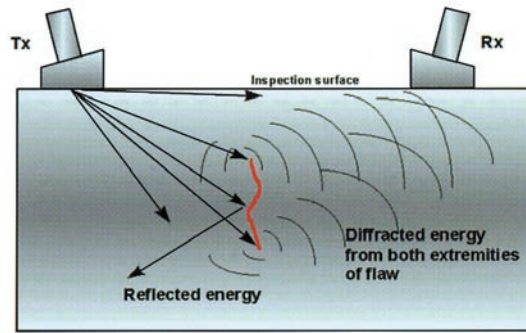
TOFD – Time-of-Flight Diffraction

Ultrasonic inspection with rapid, reliable and accurate results



Key Features of the System

- ⊕ Detection is independent of type and orientation of flaws
- ⊕ Reproducibility and accuracy is measurable to <math><0.5\text{mm}</math>
- ⊕ Consistent results between pre- and post-heat treatment and pre- and in-service inspections
- ⊕ Rapid scan rates using single pass technique
- ⊕ Permanent record with graphic images
- ⊕ On-line analysis provides real-time results and instant sentencing
- ⊕ No radiation hazard.

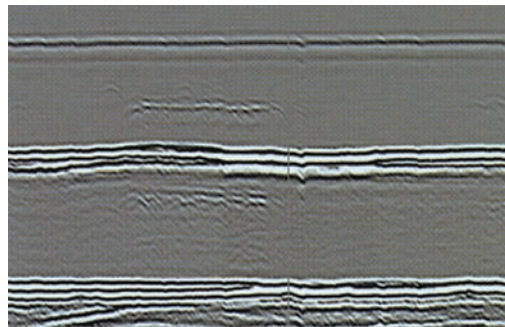


Principles of TOFD

The Time-of-Flight Diffraction technique (TOFD) was originally developed as a method of accurately sizing and monitoring the through-wall height of in-service flaws in the nuclear industry. It is equally effective in weld inspection for the detection of flaws, irrespective of type or orientation, since TOFD does not rely on the reflectivity of the flaw but uses the diffracted sound initiating from the flaw tips.

In the TOFD technique the transmitting and receiving probes are located equidistant over the weld centre and scanned parallel with the weld. Normally a single pass is sufficient to attain the required inspection coverage.

A transmitting probe emits a short burst of sound into a material, and this energy spreads out and propagates in an angular beam. Some of the energy is reflected from the flaw, and some is incident to the flaw and is diffracted away. A fraction of this diffracted sound travels toward a receiving probe; the signals are time resolved using simple geometry calculations and are graphically displayed in a greyscale form.



A lateral wave propagates just below the surface and in conjunction with the known ultrasound velocity is used in depth measurements.

In addition, the following signals can be observed:

- ⊕ the diffracted signal from the upper tip of the flaw
- ⊕ the diffracted signal from the lower tip of the flaw
- ⊕ the backwall (inner) surface from the longitudinal wave
- ⊕ the backwall (inner) surface from the trailing shear wave component.

The data are collected using a simple single-axis scanning frame with an encased optical encoder for positional information.

They can be enhanced by special software routines and analysed on **Applus RTD's** $\mu+$ ultrasonic imaging system.

Applus RTD

Applus RTD provides the following services as individual packages or combined to provide a total Asset Integrity Management programme.

- ⊕ **Advanced (non-intrusive) Inspection Services**
- ⊕ **Sub-sea Inspection Services**
- ⊕ **Engineering Design Solutions**
- ⊕ **Risk Based Inspection Planning**
- ⊕ **Inspection Management Services**
- ⊕ **In Service Inspection**
- ⊕ **Plant Life Management**
- ⊕ **Metallurgical Services.**

Importantly, **Applus RTD** can also call upon extensive in-house expertise and resources for advanced inspection and conventional NDT, providing a total capability for management of through life plant integrity.

Applus RTD, in collaboration with our local and international partners, has extensive experience in the application of these services to a wide range of industries including:

- ⊕ **Oil & Gas**
- ⊕ **Petrochemical**
- ⊕ **Refining**
- ⊕ **Ore Processing and Handling**
- ⊕ **Power Generation.**