Detection and Location of Acoustic Emissions from Partial Discharge

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Introduction

There are a number of different types of Acoustic Emission (AE) Systems used to detect and/or locate partial discharges in transformers. The speakers will describe some of them:

- **Acoustic system manufacturer and consultant: Hemchandra Shertukde, Diagnostic Devices, Inc.**
- **Transformer manufacturer: Andreas Garnitschnig, VA TECH ELIN**
- **Utility user of continuous on-line AE system: Steve Skinner and Wes Clark, Idaho Power Co.**
- **New technology: Barry Ward, EPRI**

Acoustic Emission (AE): elastic wave, in the range of ultrasound usually between 20 KHz and 1 MHz, is generated by the rapid release of energy from the source within a material.

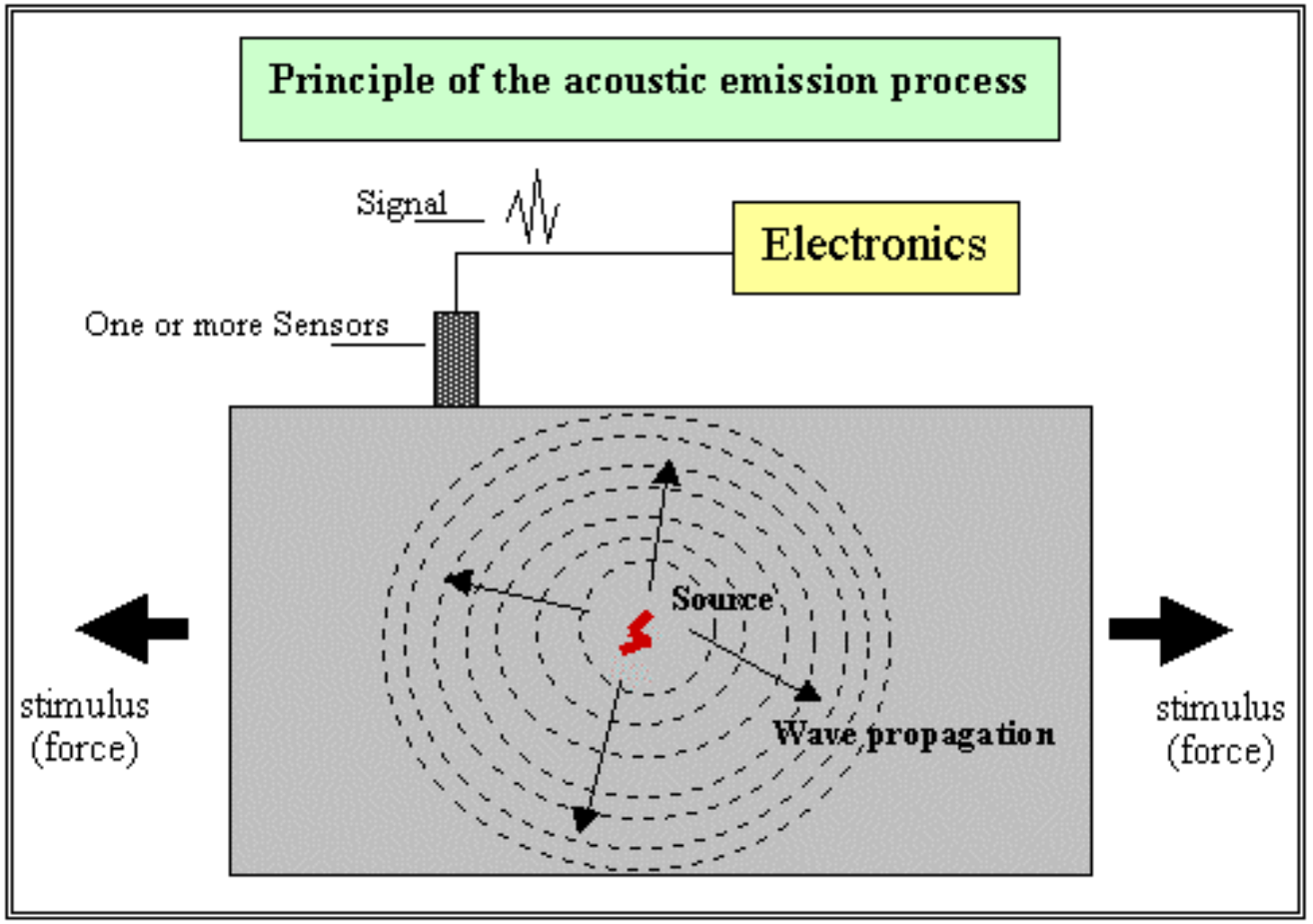
The elastic wave propagates through the solid and/or liquid to the surface, where it can be recorded by one or more sensors.

The sensor is a transducer that converts the mechanical wave into an electrical signal. In this way information about the existence and location of possible sources is obtained.

AE differs from ultrasonic testing, which actively probes the structure; acoustic emission listens for emissions from active defects.

In the context of today's panel discussion, AE analysis is used successfully for detecting and locating partial discharges from components subjected to high voltage.

The disadvantage of AE is that commercial AE systems can only estimate qualitatively how much damage is in the material and approximately how long the components will last. Other methods are still needed to do more thorough examinations and provide quantitative results.


Principle of the acoustic emission process
Signal
Electronics
One or more Sensors
Source
Wave propagation
stimulus
(force)
stimulus
(force)

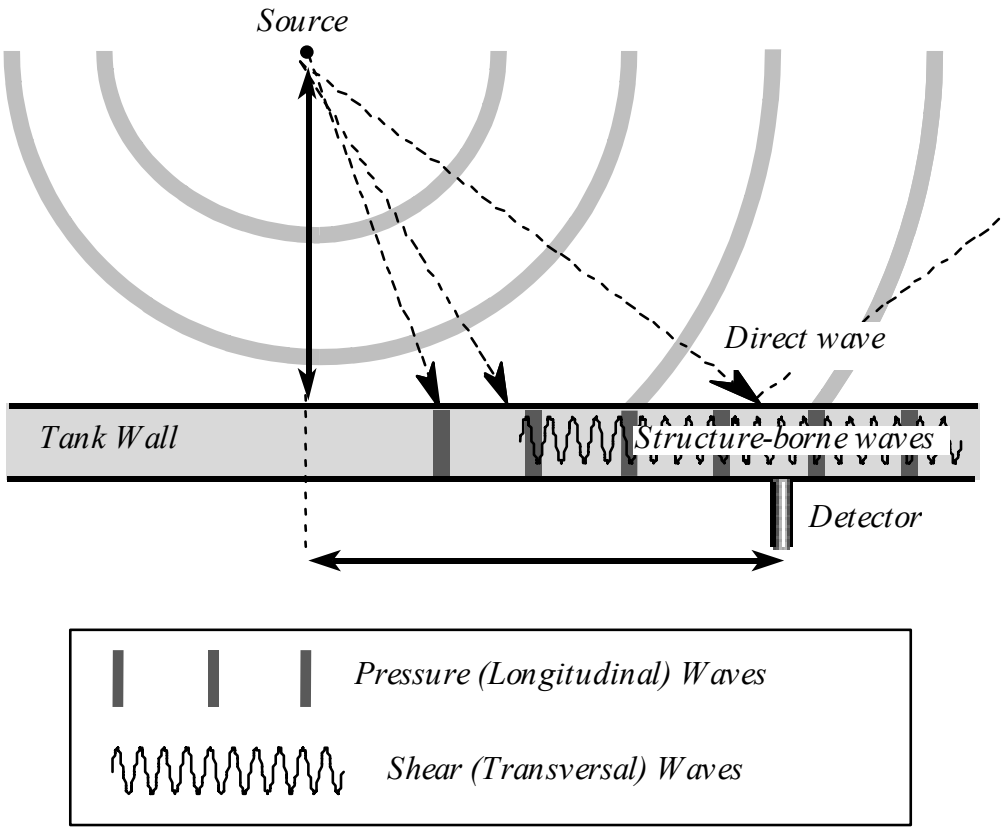
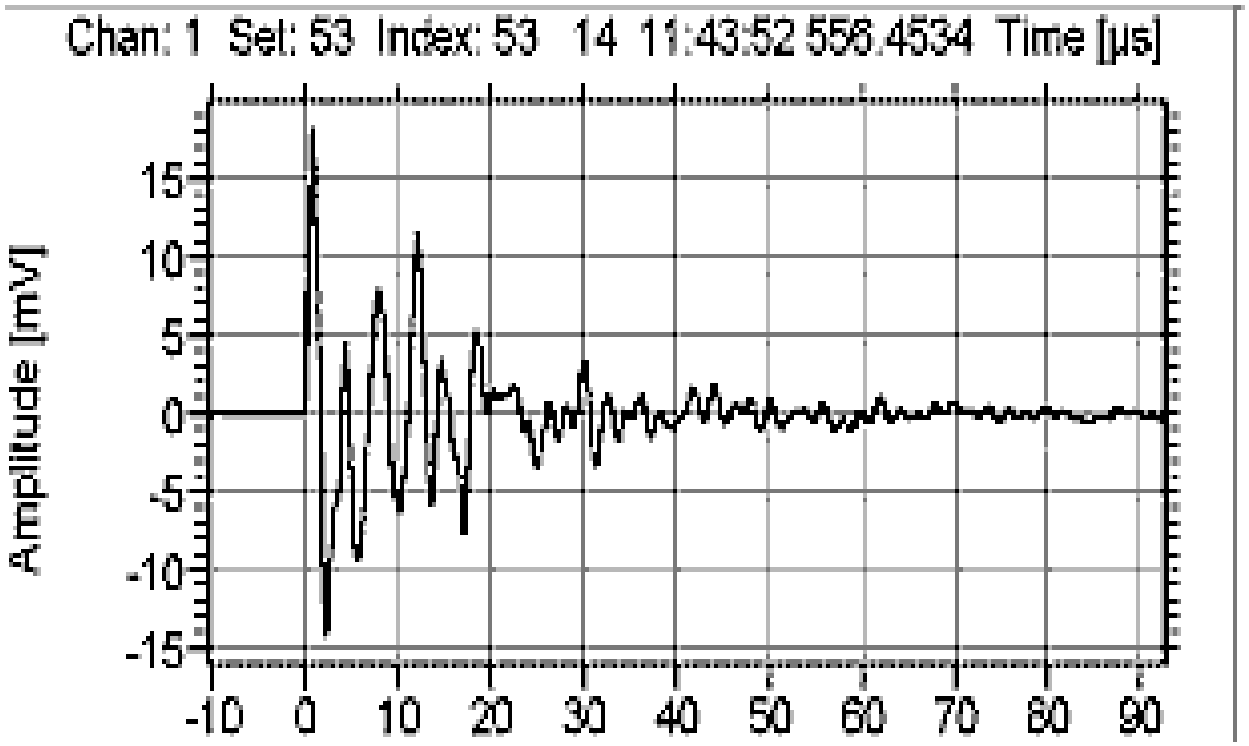


Illustration of the longitudinal and transversal waves in the tank wall and how they are created from direct waves



Typical AE burst

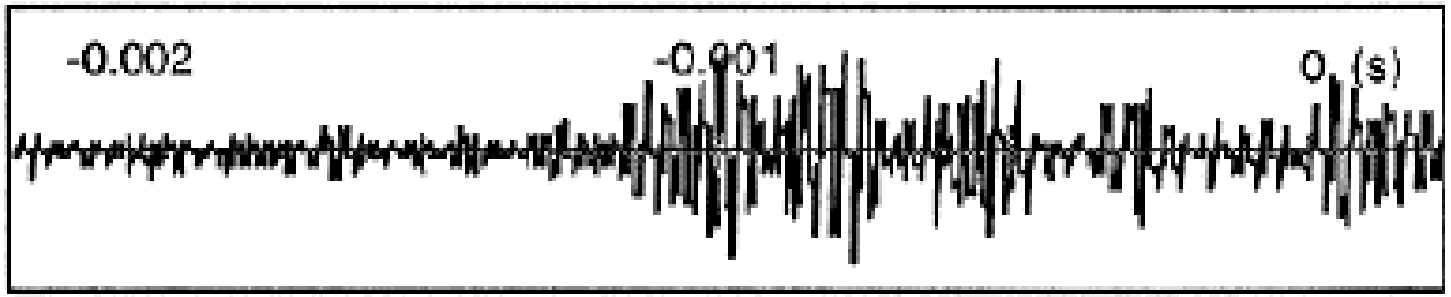


Fig. 7: Acoustic PD signal that has passed through materials inside the transformer. Note the slow rise time and the extended pulse duration.