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Acoustic tomography. Laboratory technique Implementation.

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From geomechanical tests carried out on rocks it is possible to determine its physico-mechanical properties, which relate the strain and applied stress; even so, conventional tests do not allow to identify how stress is distributed and how it has affected porous media. Today, techniques like acoustic tomography widely used in medicine, geophysics and others sciences, generates images by sections of the interior of a body. Acoustic tomography allows inferring the stress state within porous media; since wave velocities are closely related to media density, if a stress is applied to a rock, it will generate grains compaction and this will be showed by an increase of wave velocity.
Implementation was conducted on rock plugs under diverse stress fields, simultaneously recording P-wave velocities (Compressional) on perpendicular planes to sample vertical axis. Transmission and reception of acoustic waves through porous media were done by piezoelectric crystals (PZT) used as sensors. A transmitting crystal excited by a voltage pulse causes a mechanical vibration, which travels across media; this is known as inverse piezoelectric effect. This vibration is recorded by a receiving crystal in which the direct piezoelectric effect appears; which dictates that if a piezoelectric is disturbed mechanically, an electrical signal between its terminals will appear. This electrical signal is used to obtain the wave velocity. Nevertheless, acoustic tomography corresponds to one of those called inverse Problems that arise when from observed data the model parameters must be obtained; in this way, tomography involves iterative reconstruction techniques (ART or SIRT) which are projections of observed data and its later inversion.
Obtained results are cross-sectional images of velocity within the rock. In these images it is possible to identify where stress has a greater concentration observing the color map generated; thus, a greater velocity density area corresponding to a greater stress will be colored with a higher tonality within the palette used.