**Seismic response of fractures and induced anisotropy in poroelastic media**

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A planar fracture embedded in a fluid-saturated poroelastic -- Biot - medium

can be modeled either as a extremely thin, highly permeable and compliant

porous layer or employing suitable boundary conditions.

A Biot medium containing a dense set of aligned fractures behaves as an effective

transversely isotropic and viscoelastic (TIV) medium when the average

fracture distance is much smaller than the predominant wavelength

of the traveling waves. This leads to frequency and angular variations of velocity and

attenuation of seismic waves. P-waves traveling in this type of medium

induce fluid-pressure gradients at fractures and mesoscopic-scale heterogeneities,

generating fluid flow and slow (diffusion) Biot waves, causing attenuation

and dispersion of the fast modes (mesoscopic loss).

A poroelastic medium with embedded aligned fractures exhibits

significant attenuation and dispersion effects due to this mechanism,

which can properly be represented at the macroscale with an equivalent TIV medium.

In this presentation, we apply a set of compressibility and shear harmonic

finite-element (FE) experiments on representative samples of fractured highly heterogeneous Biot media to determine the five complex and frequency dependent stiffnesses characterizing the equivalent TIV medium at the macroscale.

The FE experiments consider brine or patchy brine-CO$\_2$ saturated samples and

a brine saturated sample with an heterogeneous (fractal) skeleton with fractures.

We show that fractures induces strong seismic velocity and Q anisotropy, both for

qP and qSV waves, enhanced either by patchy saturation

or frame heterogeneity. Finally we illustrate the propagation of waves at the macroscale

for the case of horizontal and vertical aligned fractures employing the equivalent media determined at the mesoscale.