# CHARACTERIZING FRACTURE INFILL FROM ITS SEISMIC RESPONSE: SYNTHETIC MODELLING AND LABORATORY EXPERIMENTS

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The presence of fractures and their characteristics determine the behavior of a rock mass, including its strength, stiffness, and all forms of conduction and diffusion – hydraulic, electrical, chemical and thermal. Fracture characteristics include orientation, spatial density, type and degree of saturation of the infill material, connectivity, fracture width and roughness. In this research we have looked at the seismic response of the fracture infill material while maintaining other fracture properties constant. In the context of near-surface geophysical applications, characterizing the fracture infill is important in geotechnical engineering, hydrogeology and contaminant transport management/mitigation.
The response of a single fracture in an elastic medium has been derived using the linear slip theory. This theory involving particle displacement or velocity discontinuity boundary condition has earlier been found useful to describe the transmission or reflection response at non-welded interfaces. Unlike the effective medium theories, this approach allows one to study the seismic response of a single fracture in terms of the fracture compliance (1/stiffness) even when the seismic wavelength is much larger than the individual fracture thickness. The goals of the present research are to look into the dependence of the fracture transmission response on the frequency and angle of incidence of the seismic wave, and to verify these theoretical results through careful laboratory experiments. We could resolve on laboratory data the frequency- and angle-dependence of the fracture compliance, and explain these results using the theoretical response derived for the full elastic case. Our results suggest the possibility of retrieval of fracture compliance as a function of fracture infill from the elastic transmission or reflection response.