Effect of transient vibration on sheared granular materials

*Ryunosuke Sakamoto[1], Takahiro Hatano[1]

1. Osaka University

Seismic wave emitted by an earthquake can trigger an earthquake on a distant fault. This phenomenon is called dynamic triggering. For example, in California, dynamic triggering occur when the stress change due to seismic waves is larger than ~0.1 kPa (Van Der Elst and Brodsky, 2010). The stress change due to seismic waves is on the order of magnitude smaller than the stress drop of an earthquake. Various mechanisms have been proposed to explain why such a small change in stress can trigger an earthquake (Hill and Prejean, 2015). One of them is fluidization of fault gouge, which occurs when fault gouge is shaken by seismic waves. Although previous studies have shown that fault gouge can be fluidized by transient vibration (e.g., Ferdowsi et al., 2015; Jhonson et al., 2016), our understanding of the physical mechanism is not sufficient. Therefore, we modeled the fault gouge using the individual element method and numerically analyzed how it responds to transient vibration. Specifically, the gouge layer is sandwiched between two substrates at the top and bottom, and the upper plate is pulled at a constant speed V through a spring with a spring constant k. This produces a stick slip motion. In this situation, we apply a transient vibration to the bottom plate and investigate how the fault gouge responds. Preliminary numerical calculations confirm that, as in previous study, the transient vibration promote the fluidization of the fault gouge (Ferdowsi et al., 2015). In this presentation, we will present the results of coordination number and shear stress variation obtained from preliminary numerical calculations.

Keywords: Granular materials, Dynamic triggering, Stick slip

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