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Friction law of gouges from monotonic and cyclic shear tests - implications for rockslide triggered by earthquakes

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The differences of soil strength under static and dynamic loading have been well recognized. This study utilized rotary shear apparatus to elucidate the friction coefficient of gouge materials under monotonic and cyclic shearing conditions. A rigid block model incorporating the velocity/displacement dependent friction law from monotonic tests was adopted to simulate the dynamic shearing behavior. Basically, the friction coefficient under maximum shearing velocity was well depicted. However, the friction coefficient under zero velocity for dynamic shearing tests was overestimated. A frequency factor, which taking the healing effect into account, was successfully incorporated into the friction law to simulate the variation of the friction coefficient under dynamic loading condition. The modify friction law with consideration of the cyclic shearing frequency was used to evaluate the triggering of a dip slope rockslide during earthquake. It is illustrated that the cyclic shear induced from the earthquake is critical for the initiation of large scale rockslide. The influence of seismic loading on earthquake-triggered rockslide can thus be evaluated quantitatively.

Keywords: monotonic and cyclic shear, velocity and displacement dependent, friction coefficient, rotary shear test, gouge, earthquake triggered rockslide