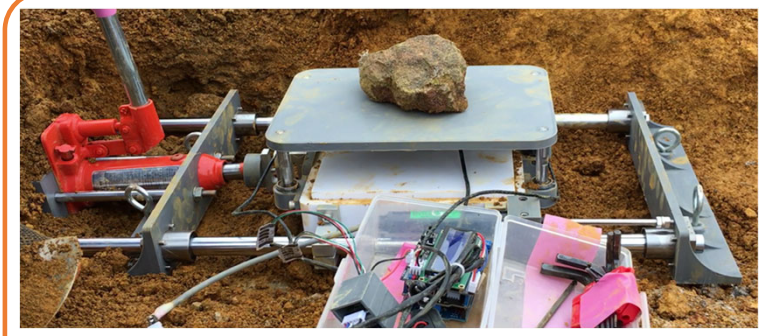
Production of Insitu Direct Shear Test Equipment by using 3D Printer and Microcontroller

3Dプリンタとマイコンを利用した原位置一面せん断試験装置の試作

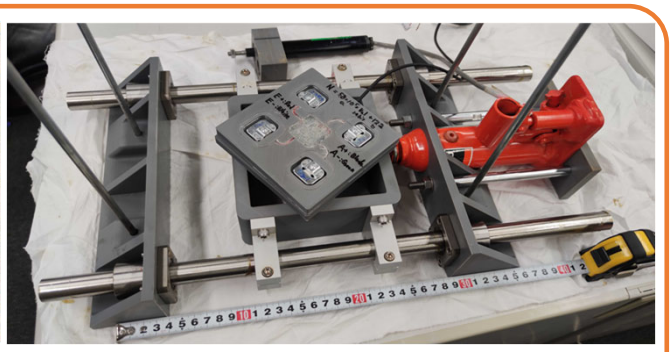
The direct shear test is very basically and generally in the soil-testing-method. But the general one has the portability, accuracy and anchoring-to-the-ground problems when we use it insitu. On the occasion of developing, we need to pick it up to top of mountain in order to test, so we should make it more lightweight. This device could resolve this problem by using the 3D-printer and the microcontroller board.

一面せん断試験は、土質試験の中ではとても一般的かつ基本的な試験です。しかし現地でこれを行うとなると、可搬性、データ精度、固定方法等の制約が出てきます。この機器の開発では更に、試験機を山頂まで運んで試験する必要があったため、なるべく金属を減らし、軽く作成することが求められました。この機器は3Dプリンタ及びマイコンを用い、その問題を解決しています。

Photo of the Whole Equipment



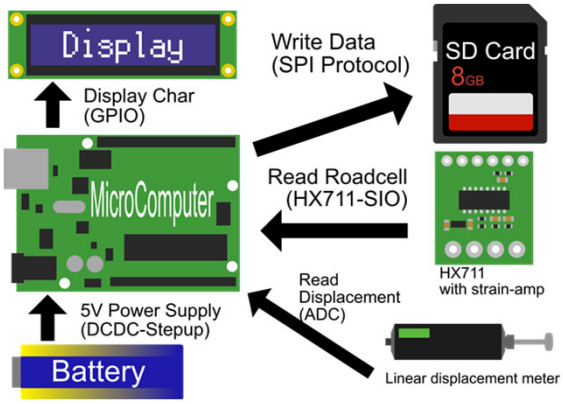
Large(30x30x5cm) Shear Box version
Testing at nearly top of 1600m mountain

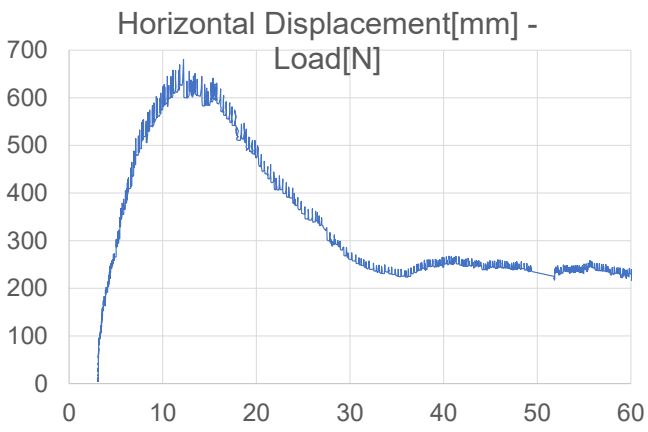


Small(20x20x5cm) Shear Box version, Developing

About System

This equipment created by using the **3D-Printer** and the **microcontroller board** is basically same as general **direct shear equipment** that can get the **soil strength against the shear slip**. This is. The software can run on **even Arduino**, because standalone and small footprint. The hardware is also small footprint, because of can be structed by several stackable shields. In addition, this equipment can run by **AA/AAA battery** and the equipment body **made by PLA** (3D printer material). So, the portability is quite good.





Test Result Sample

This result is the sample in case of **111Pa(10N) loading pressure**, for the volcanic soil include gravel and using handy oil jack, **large(30cm) shear box**. The jack can be moved only little bit by one paddling. And the many small pulse that you can see in the left graph means the timing that the jack started moving. As you can see, we can easily get the **residual strength** (around 250N) and the **peak strength** (around 630N) from the graph.

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