Development of Multi-Directional Elastic Wave Measurement System Using Disk-Shaped Piezoelectric Transducers

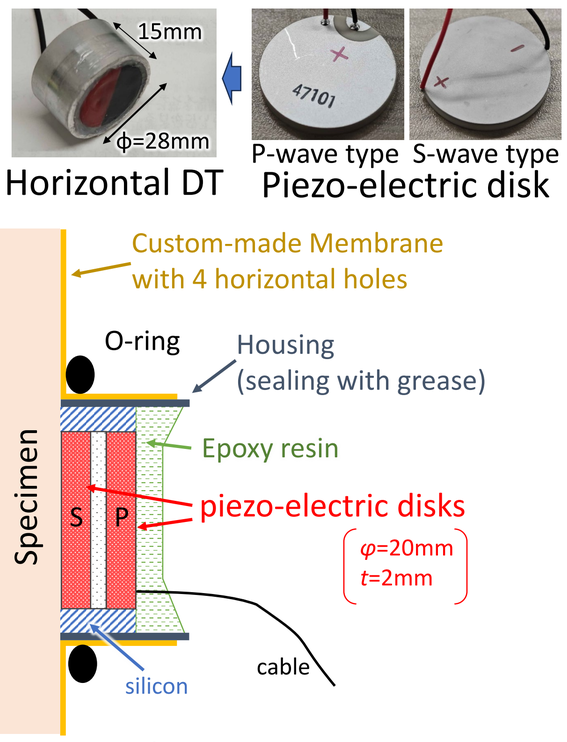
ディスクトランスデューサーを用いた多方向弾性波計測システムの開発

Overview

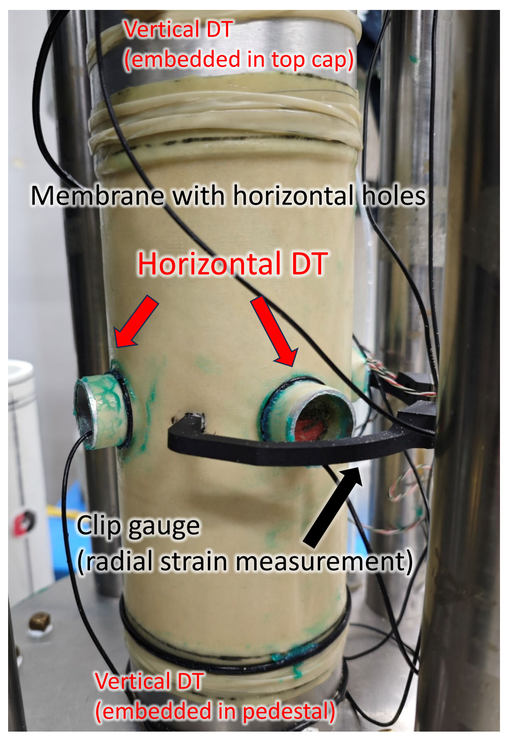
The elastic wave velocities and small strain stiffnesses of soils are essential parameters that are used in the design of foundations, tunnels, etc. Disk-shaped piezoelectric transducers (DTs) developed at IIS have been used for measuring elastic waves propagating through geomaterials. In this study, these transducers were modified to develop a system capable of automatic multi-directional elastic wave measurements in triaxial specimens. Changes in multi-directional elastic wave velocity of dry Toyoura sand during triaxial compression are presented.

桑野研究室では、ディスクトランスデューサー(DT)を用いて地盤材料を伝わる弾性波速度の計測が行われている。本研究では、DTを用いて、三軸供試体で弾性波の多方向自動計測を行うシステムを開発した。このシステムを用いて、乾燥豊浦砂の三軸圧縮中の弾性波速度の計測を行った結果を示す。

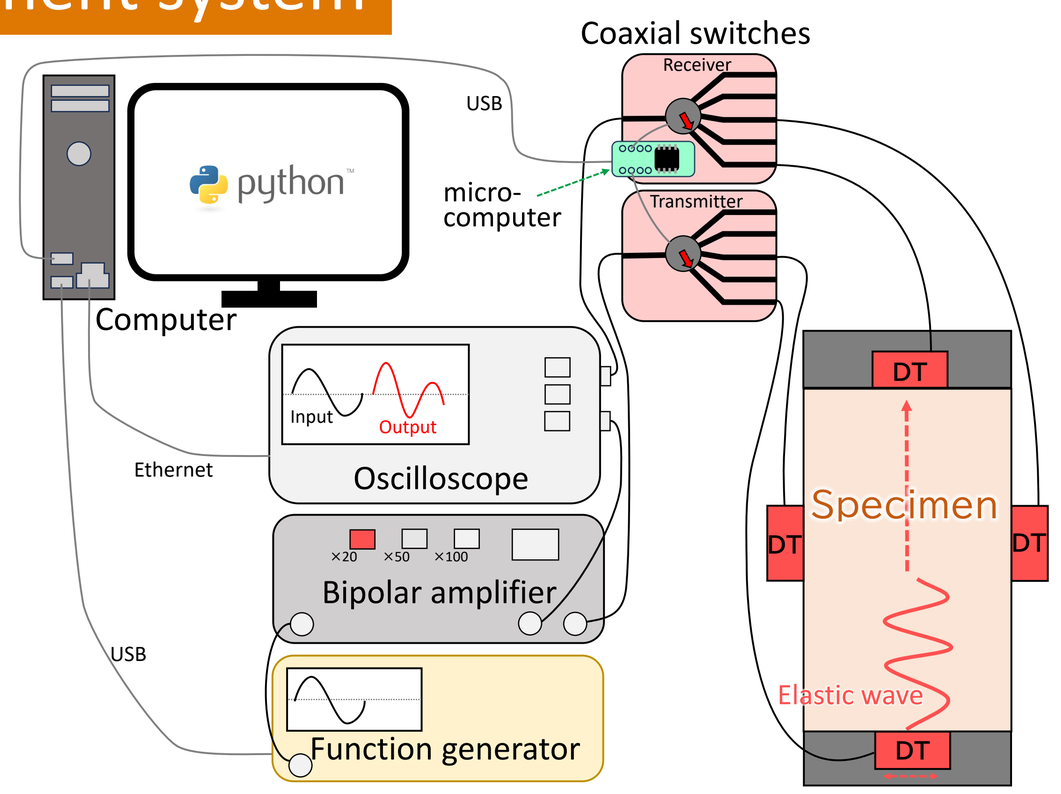
Multi-directional elastic wave measurement system



Vertical cross section



Appearance of the specimen

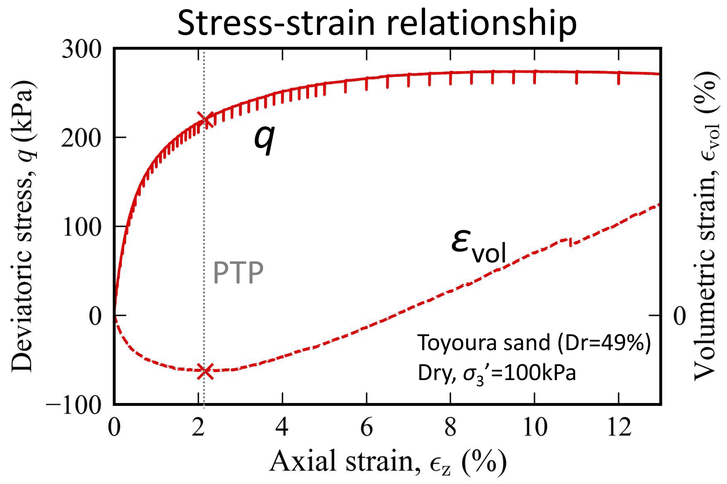


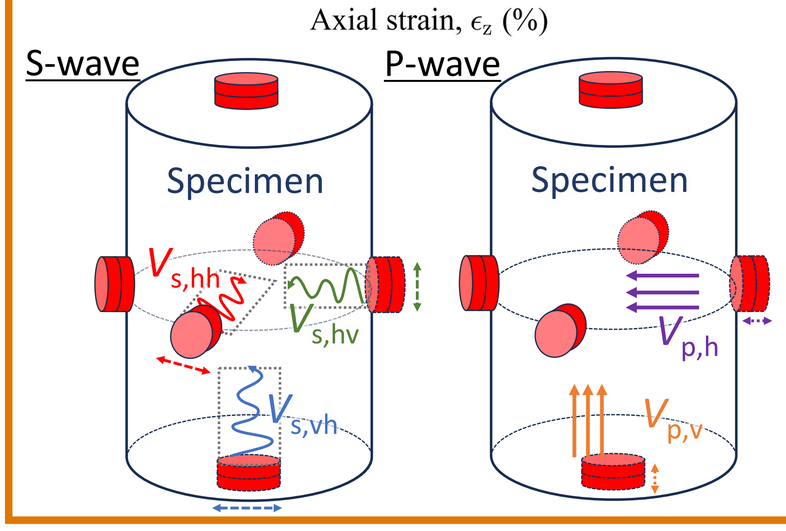
Automatic multi-directional elastic wave measurement system

✓ non-inversive ✓ easy to seal ✓ Automated measurement of 3 S-waves and 2 P-waves in 10 seconds

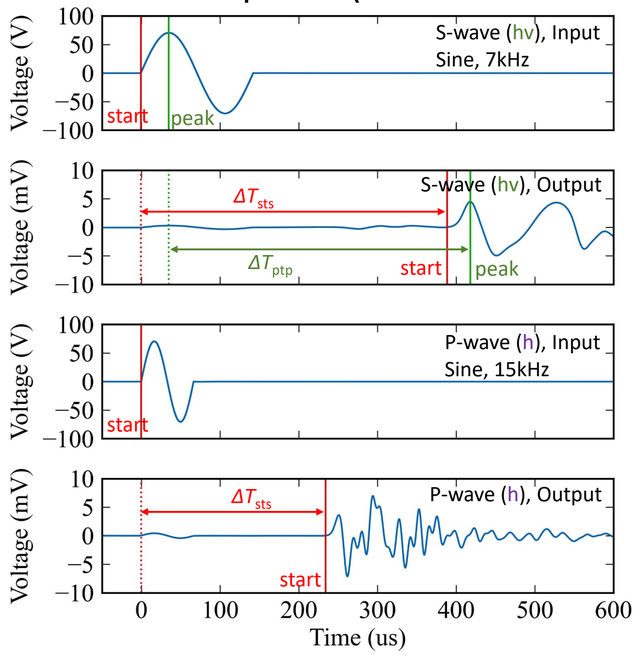
Results

Stress-strain relationship

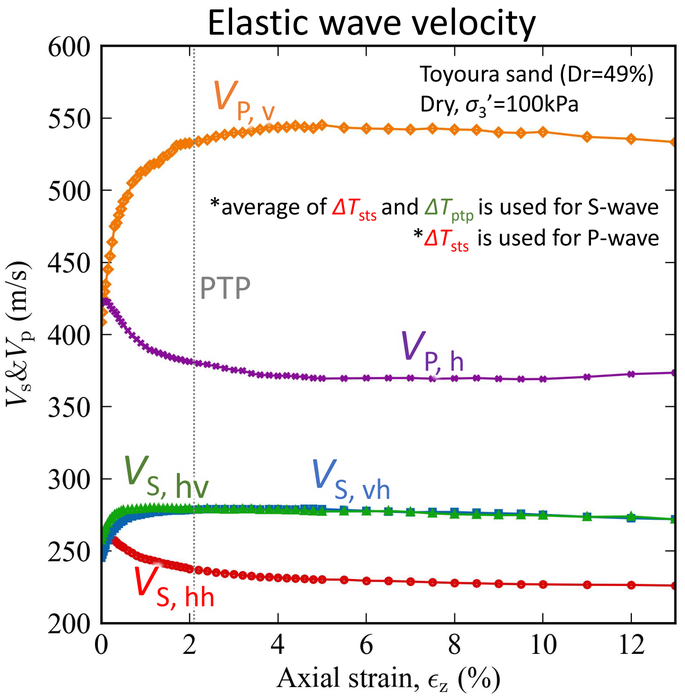




Time-domain response (after consolidation)



Elastic wave velocity



✓ $V_{s,hh}$ and $V_{p,h}$ decreased with increasing axial strain.

✓ $V_{s,hv}$ and $V_{S,vh}$ exhibited peaks at phase transformation point (PTP) and subsequently decreased.

✓ $V_{p,v}$ increased until around the peak of q, followed by a slight decrease with strain softening.

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