ELASTIC WAVE MEASUREMENT

SIMULTANEOUSLY OBTAINED P & S WAVES BY DISK TRANSDUCER

ディスクトランスデューサーによるP波・S波の同時測定

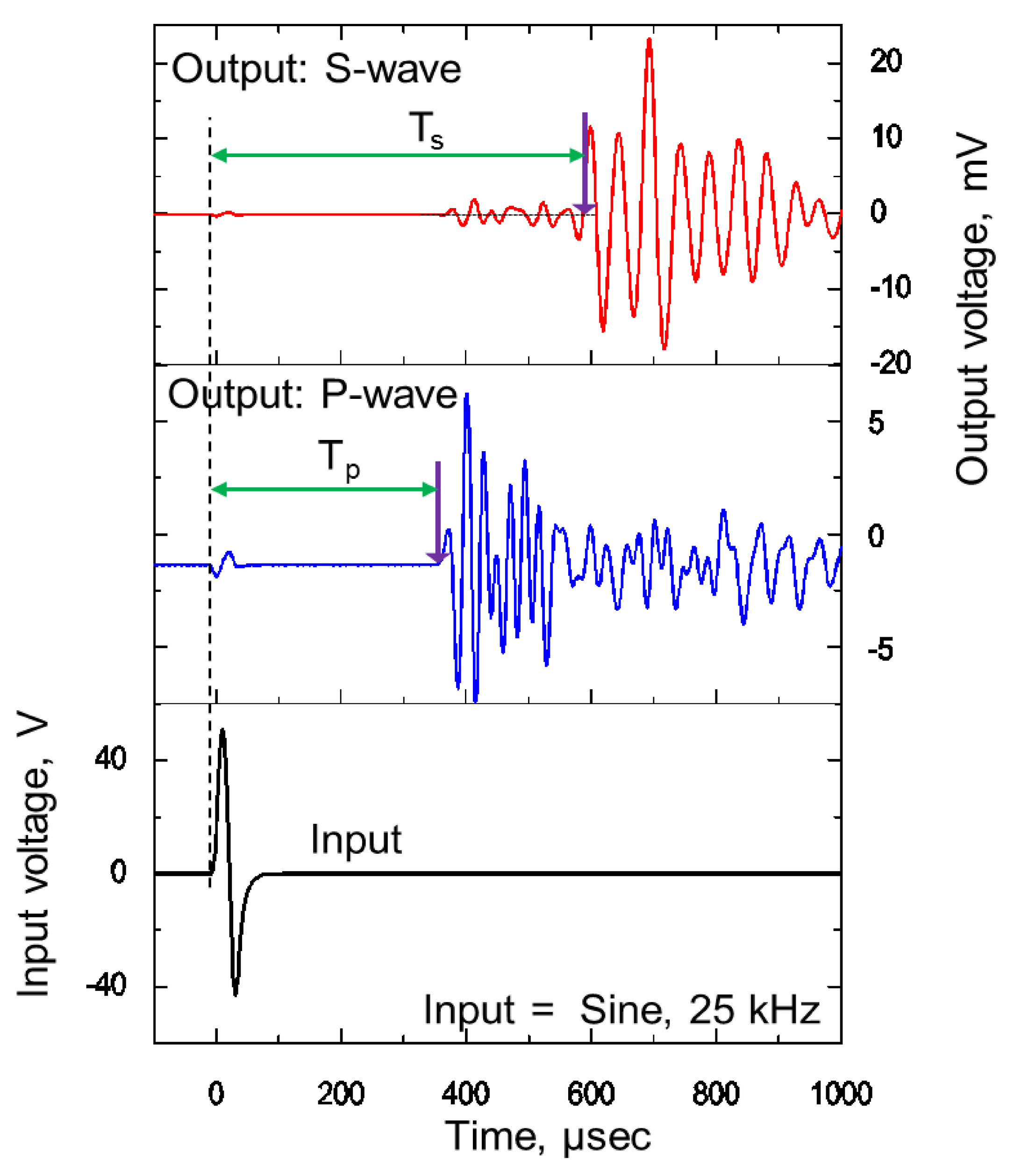
Recently developed flat disk shaped piezo-ceramic transducer, “Disk Transducer” is employed on the cylindrical triaxial specimen of 75 mm in diameter and 150 mm in height in several granular geo-materials. Both compressional and shear (P and S) waves were propagated exciting P type and S type piezo-ceramic elements together and the corresponding responses (received compressional and shear waves) are achieved simultaneously.

室内土供試体のP波とS波速度を同時に測定できる、ディスクトランスデューサーを開発しました。粒径の異なる3種類の砂で得られた結果を示します。

SIMULTANEOUSLY ACHIEVED COMPRESSIONAL AND SHEAR (P AND S) WAVES ON GRANULAR MATERIALS

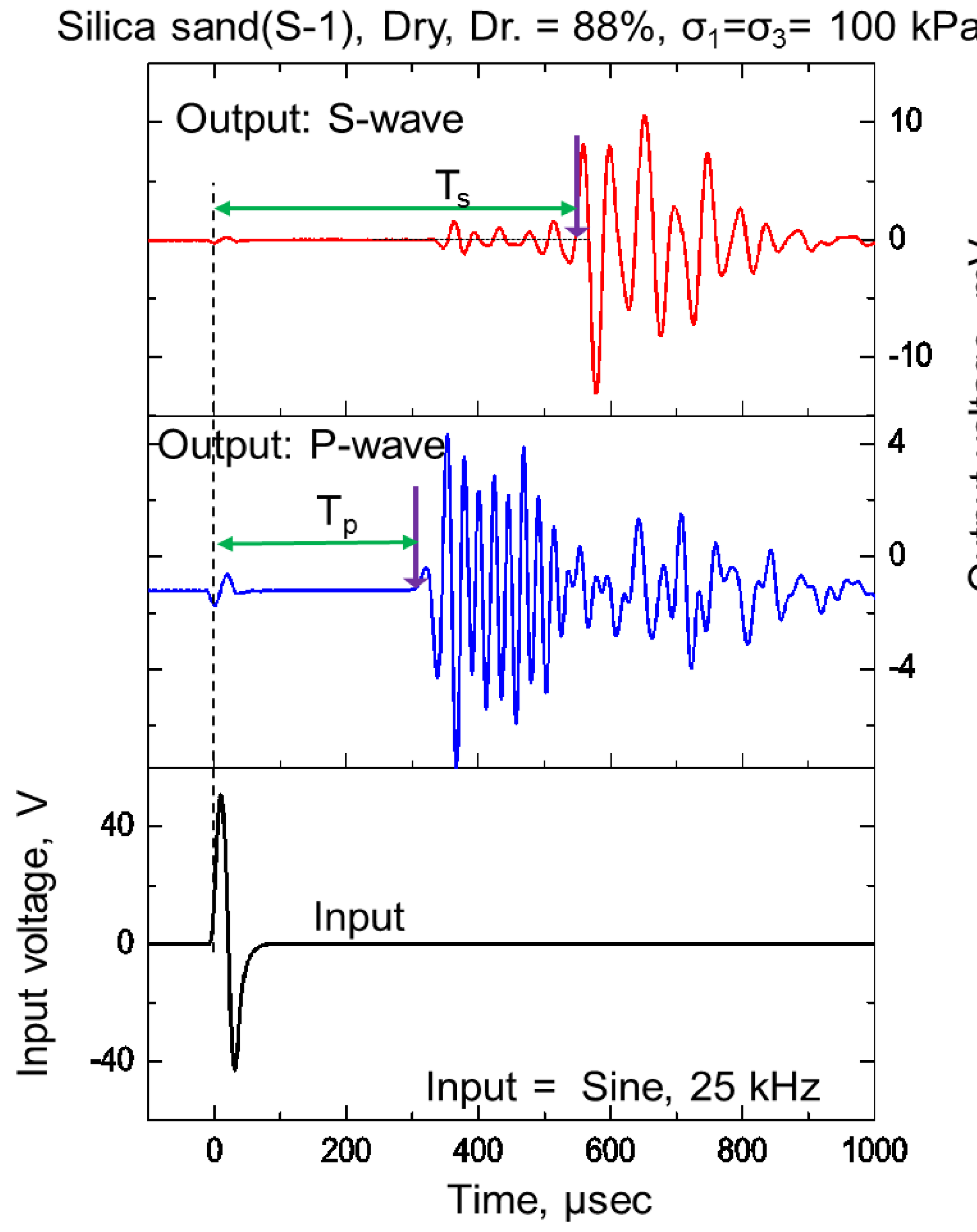
Waveforms obtained on Toyoura sand

Toyoura sand (T-3), Dry, Dr. = 68%, $\sigma_1=\sigma_3$= 100 kPa



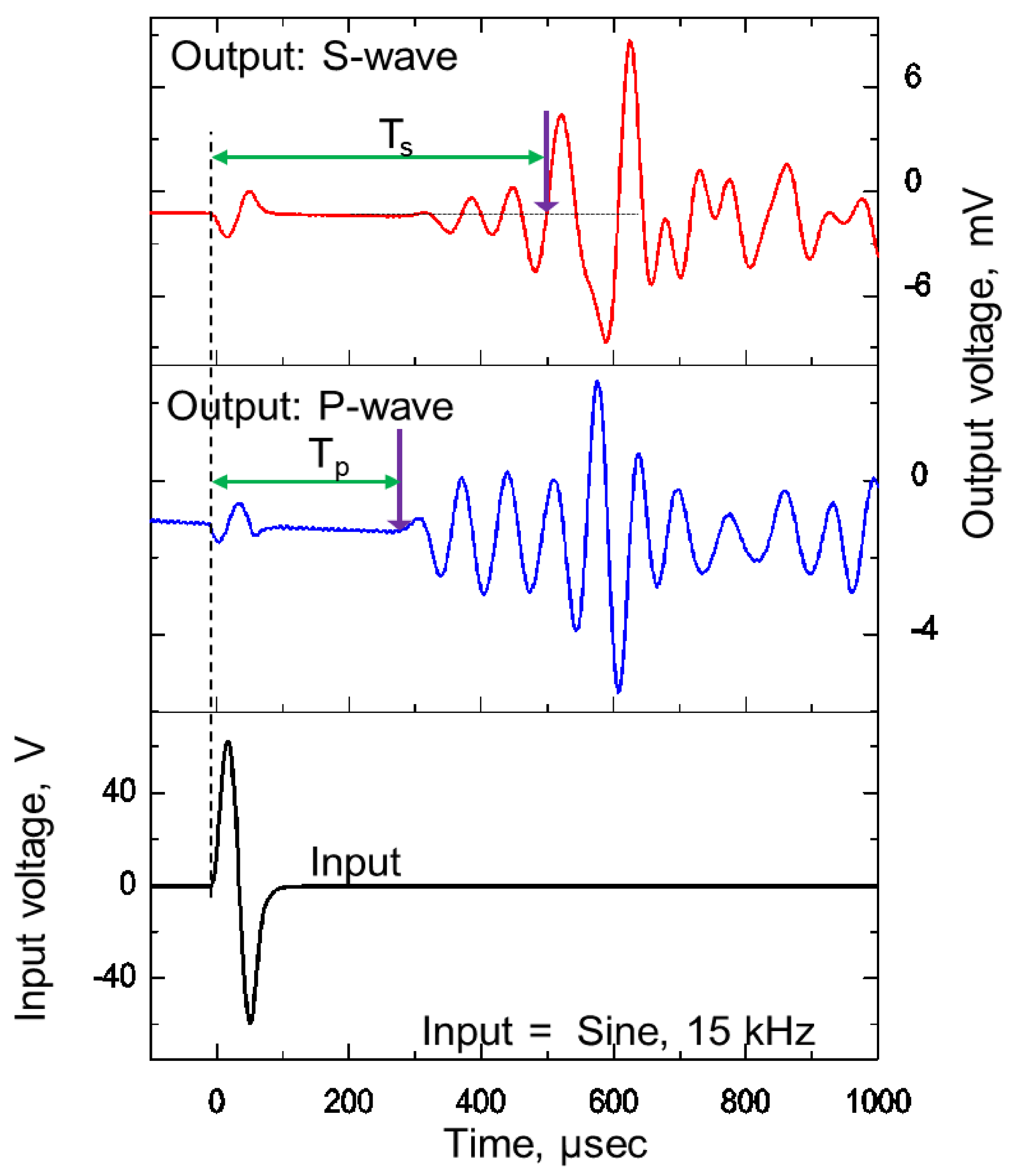
Waveforms obtained on Silica sand

Silica sand(S-1), Dry, Dr. = 88%, $\sigma_1=\sigma_3$= 100 kPa



Waveforms obtained on Hime gravel

Hime gravel (H-2), Dry, Dr. = 76%, $\sigma_1=\sigma_3$= 100 kPa



RELATIONS TO EVALUATE MATERIAL PROPERTIES

Relations used in elastic wave measurement

Velocity of the wave: $V_P = \frac{H}{T_P}$, $V_S = \frac{H}{T_S}$

Poisson’s ratio in terms of velocity: $\nu = \frac{(0.5V_p^2 - V_s^2)}{V_p^2 - V_s^2}$

Young’s modulus: $E = \frac{M(1-2\nu)(1+\nu)}{(1-\nu)}$

Constrained modulus: $M = \rho * V_p^{\ 2}$

Conversion between G and E: $G = \frac{E}{2(1+\nu)}$

Shear modulus: $G = \rho * V_s^{\ 2}$

H = Distance between two transducers (specimen height)

Static relations

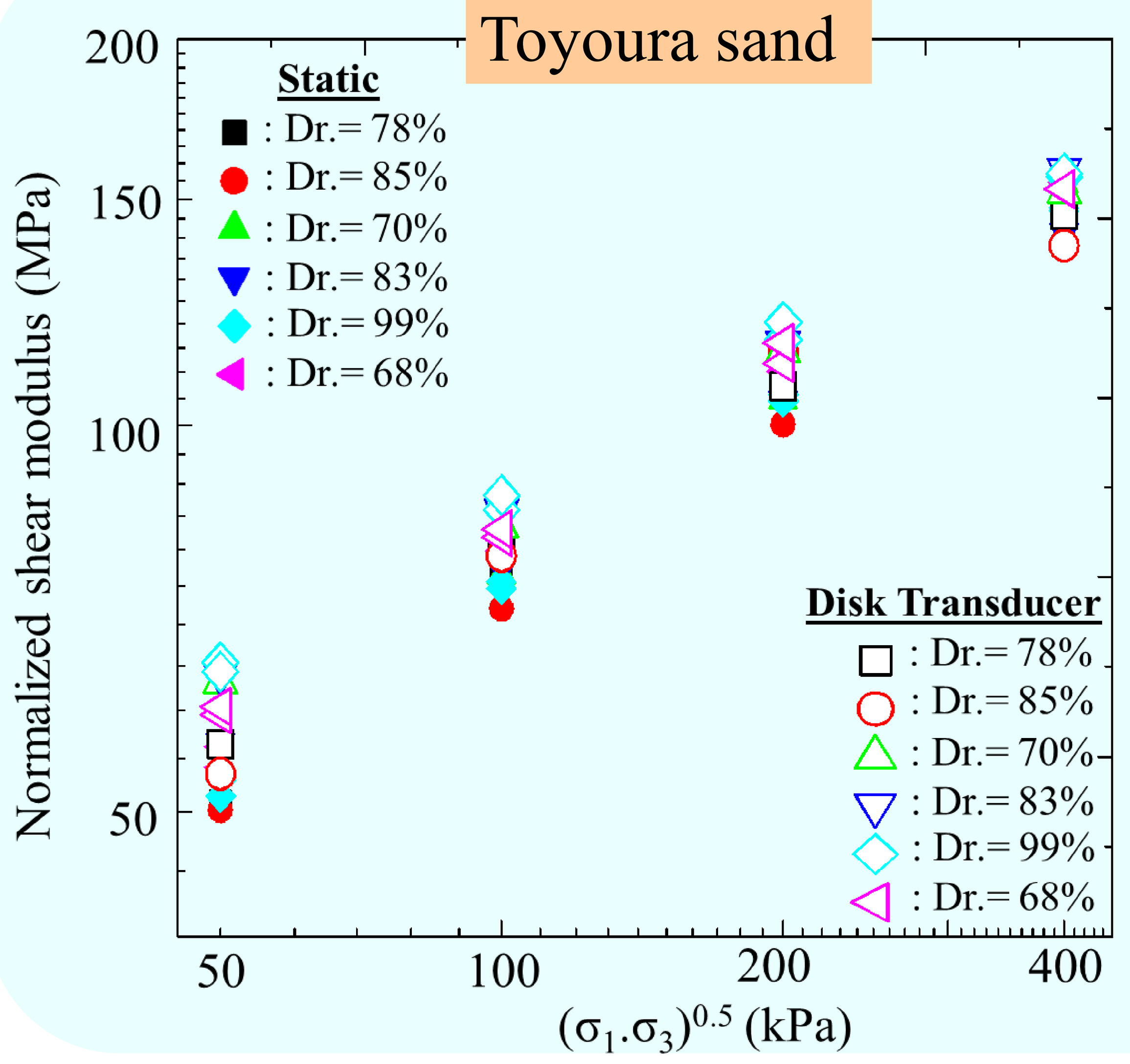
Axial (vertical) strain, $\varepsilon_a = -\int_{H_0}^{H} \frac{dH}{H} = -\ln(\frac{H}{H_0})$

Radial (lateral) strain, $\varepsilon_r = -\int_{R_0}^{R} \frac{dR}{R} = -\ln(\frac{R}{R_0})$

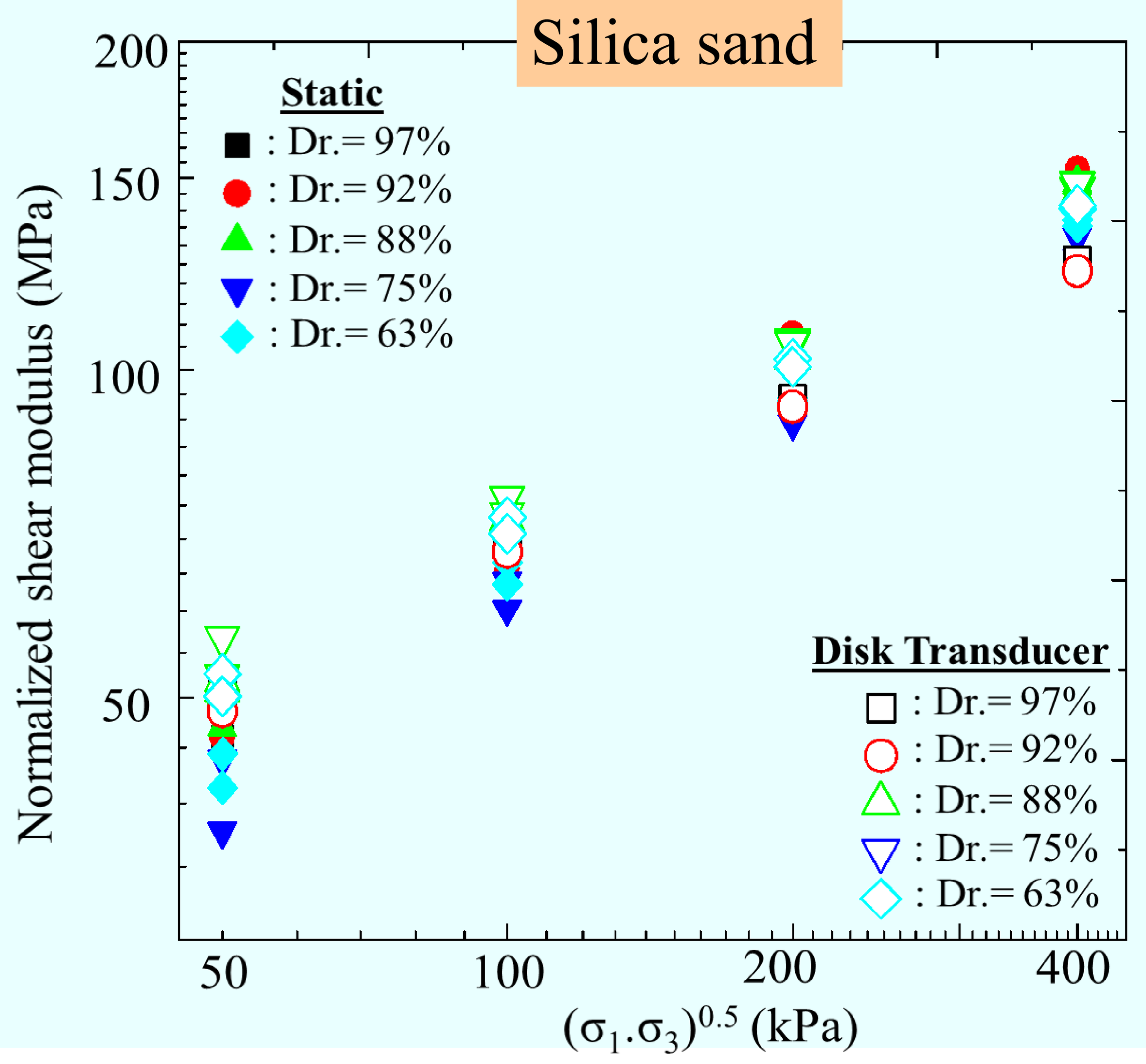
Poisson’s ratio, $\nu = -\frac{\delta\varepsilon_r}{\delta\varepsilon_a}$ Young’s modulus, $E = \frac{\Delta\sigma}{\Delta\varepsilon_a}$

Stress-Stiffness relationship

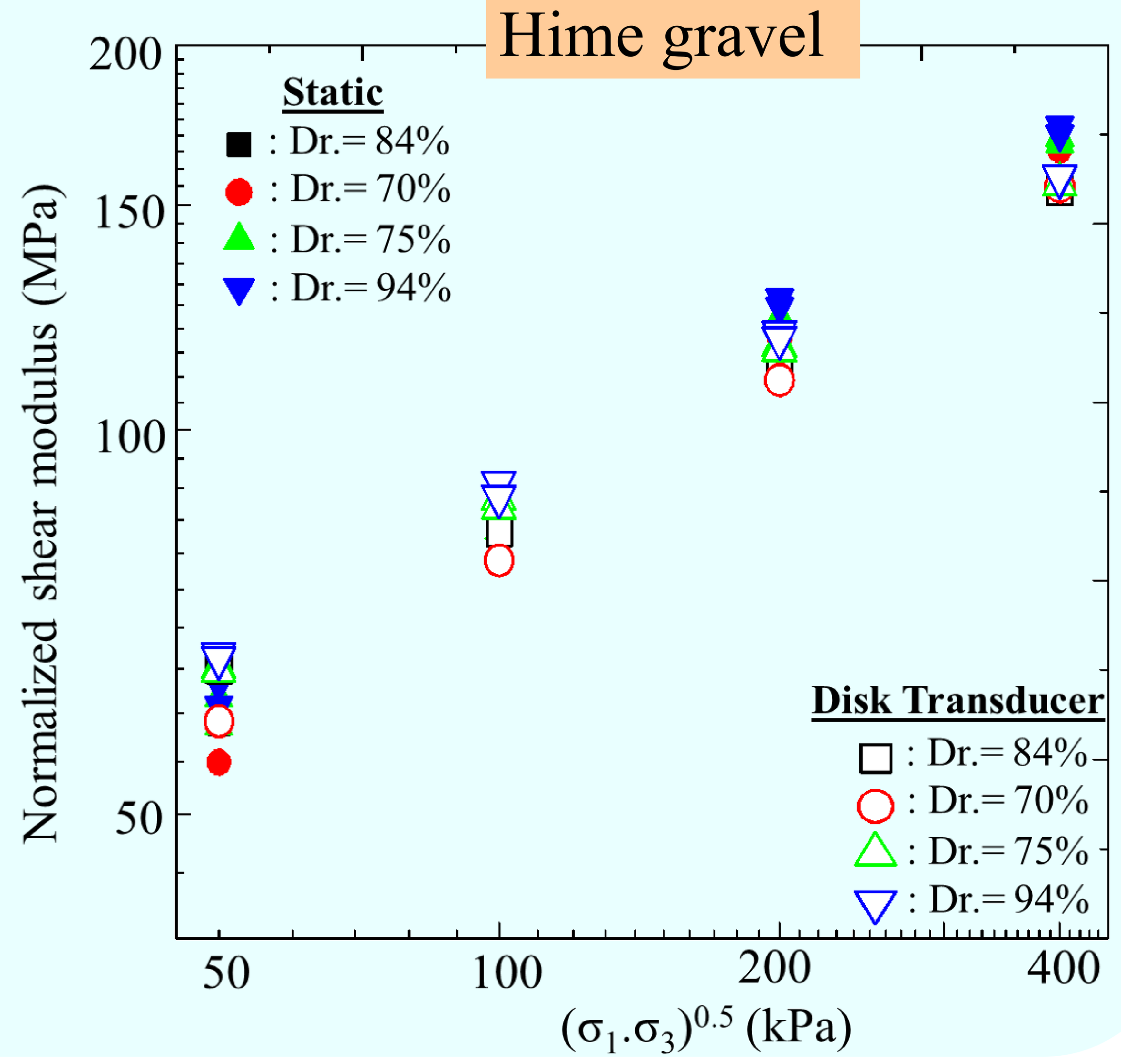
Toyoura sand



Silica sand



Hime gravel



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