Effects of Particle Shape of Granular Materials in Triaxial Tests

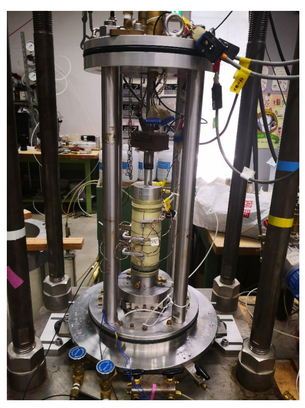
三軸試験における粒状材料の粒子形状の影響

Effects of particle shape of granular materials on dynamic responses of their assembly are significant and thus worth being studied. Different shapes would affect their microstructure such as contact fabric or orientation of particles, and lead to different dynamic behaviours, which have not been fully understood. Consequently, triaxial compression experiments were carried out by considering different particle shapes. Stress responses and wave propagation in the process of monotonic loading were investigated. To eliminate the influence of packing density, specimens consisting of different particle shapes were prepared at a similar relative density.

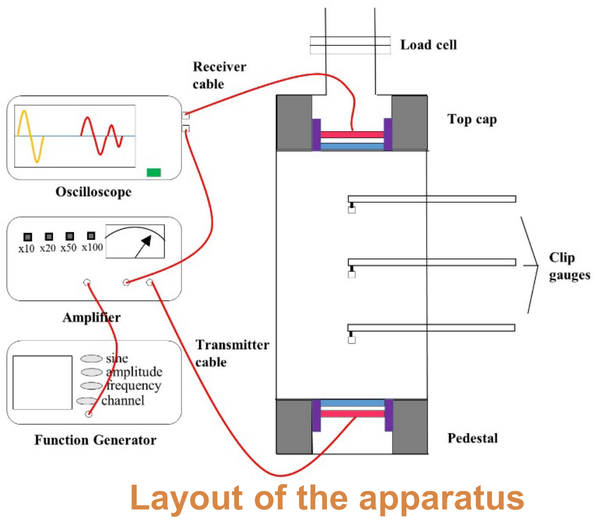
動的応答に対する粒状材料の形状の影響は大きい。粒子形状が異なることで、粒子の接触モードおよび配向性などの微視構造に影響を与え、異なる力学的挙動を示すと考えられるが、まだ完全には解明されていない。そこで形状が異なる粒状体の三軸圧縮試験を行い、単調載荷の過程における変形強度特性と波動伝播特性を調べた。充填密度の影響を排除するために、異なる粒子形状からなる供試体を同様の相対密度で作製した。

Experiment Apparatus

Wave measurement



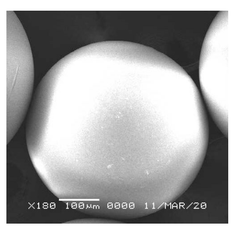
Triaxial apparatus



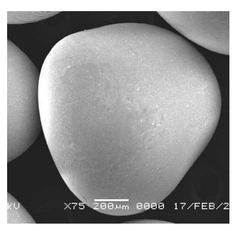
Layout of the apparatus

Tested Materials

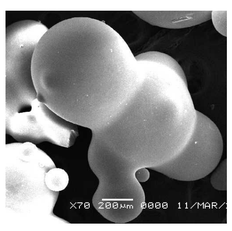
SEM photos



Spherical



Deformed

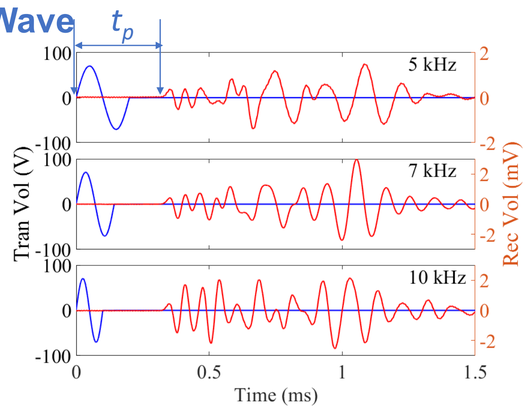


Clumped

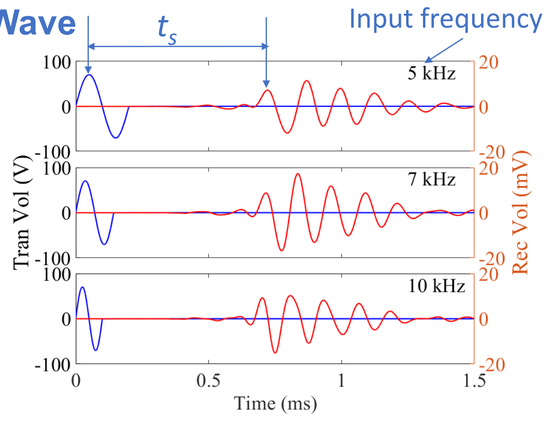
	SSGB	SDGB	SCGB
G_s	2.5		
D_{50}(mm)	0.5	1.0	0.6
e_{min}	0.589	0.494	0.694
e_{max}	0.694	0.666	0.961

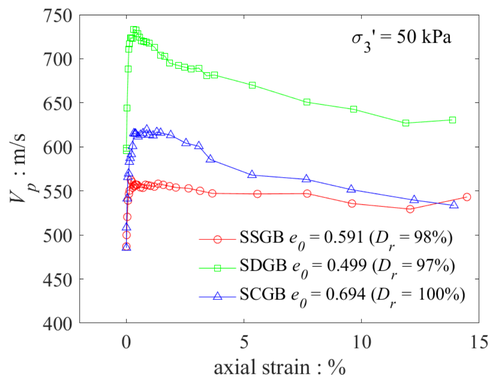
Wave Propagation

P-Wave t_p

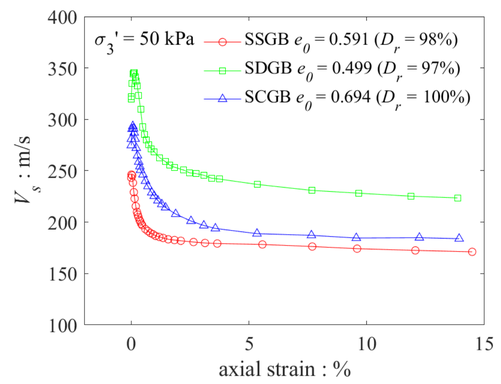


S-Wave t_s Input frequency

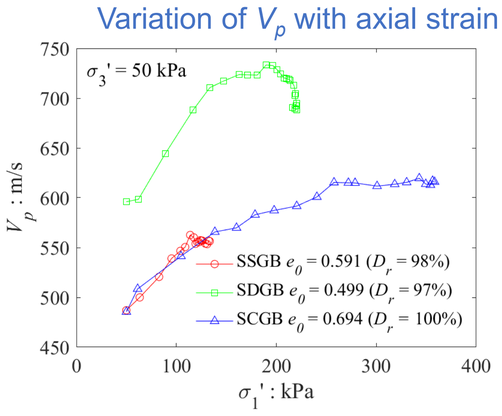




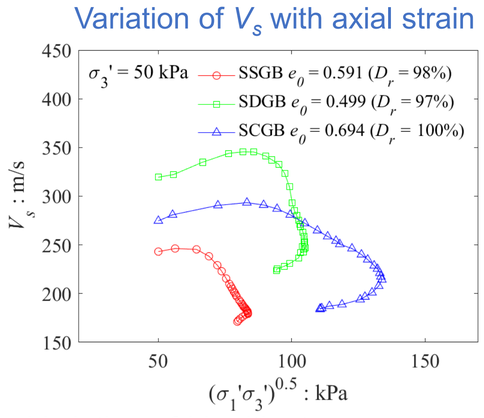
Variation of V_p with axial strain



Variation of V_s with axial strain

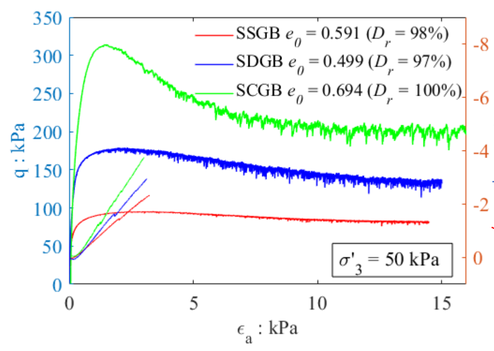


Variation of V_p with normal stress



Variation of V_s with stress components

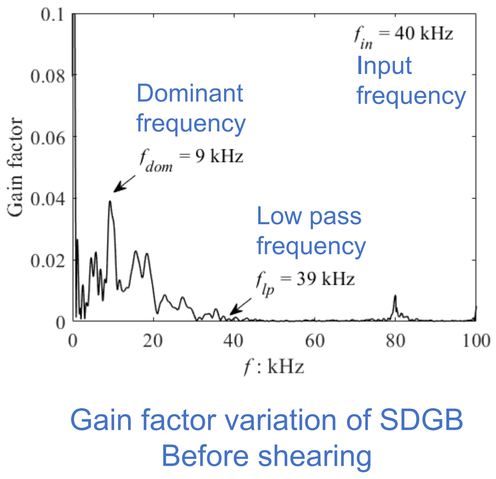
Stress Response



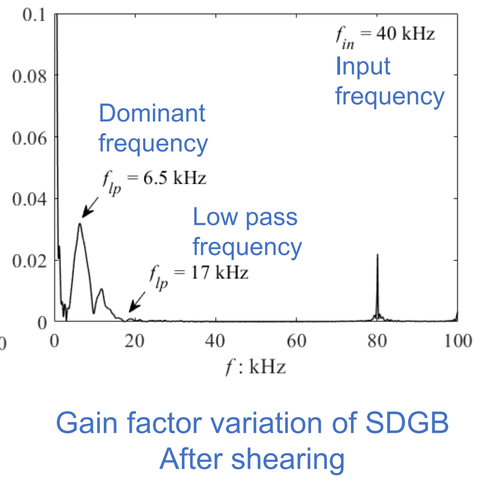
Deviatoric stress and volumetric change with axial strain due to particles with different shapes

Frequency Domain Analysis

Gain factor =FFT_{output}/FFT_{input} FFT = Fast Fourier Transform



Gain factor variation of SDGB Before shearing



Gain factor variation of SDGB After shearing

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