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Stress-State Dependency of the Deformation Ratio of Quasi-Elastic Granular Soils under Cyclic Loading -- Supporting Information

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Abstract

Poisson's ratio, besides its transverse-axial strain ratio definition, also plays a significant role in traditional elastic theory as an elastic constant. However, this elastic role of Poisson's ratio faces a challenge when applied to quasi-elastic granular soils. A so-called "deformation ratio" is therefore introduced and measured in this paper for quasi-elastic granular soils. With the same definition of the transverse-axial strain ratio as Poisson's ratio, the stress-state dependency of the deformation ratio and the break-down of conversion relationship of elastic constants are investigated under cyclic triaxial tests. The results show that Poisson's ratio is consistent with deformation ratio only in the initial state of shear, and there is a non-negligible deviation in subsequent shear. The conversion relationship of elastic constants does not hold for the deformation ratio with increasing deviator stress. A special case is analyzed when the deformation ratio is greater than 0.5 and the specimen is subject to a shear elastic dilatancy. Discrete element simulations are conducted to clarify the microscopic mechanism of elastic dilatancy by tracking the evolution of the contact number of particles and the trajectory of the contact. This study provides new insights in understanding the elastic behavior of granular soils.

Viewing Instructions

Download and view the spreadsheets of Raw Data:

- DEM
- PF series
- PF5
- PF6
- PF7
- PS series
- Strain field_x
- T111
- T112
- T113
- T114
- T124
- T134
- T144
- T154
- T214
- T314
- T414
- T514
- Strain field_y

Keywords and Phrases

Deformation Ratio; Poisson's Ratio; Quasi-Elastic Deformation State; Elastic Dilatancy; Discrete Element Method; Cyclic Triaxial Tests; Digital Image Measurement

Disciplines

Geophysics and Seismology | Geotechnical Engineering

Description of raw data

- ‘T’ series spreadsheets are the raw data of all tests. (The data in this series are overall stress and strain information).

- ‘PS’ and ‘PF’ spreadsheets are the data of the prediction and calibration tests. (The data in this series are overall stress and strain information).

- ‘Strain field_x’ spreadsheet is the radial strain information of all the nodes. The first two columns of data are location information of the node in pixel coordinates. The third column is the information recorded at the first time, the fourth column is the information recorded at the second time, and so on.

- ‘Strain field_y’ spreadsheet is the axial strain information of all the nodes. Data format is the same as ‘Strain field_x’.

- ‘DEM’ spreadsheet is the simulation results. The test information of the numerical samples is included in it.

- All the figures in this paper present representative data.