Preferred Session

Characterisation and measurement techniques

Correspondig author (Affiliation and e-mail address)

Dr. Ho-Chul Shin (h.c.shin@open.ac.uk)

Oral / Poster Presentation Prefered

Oral presentation is preferred.

Oral presentation special requirements (i.e. loudspeakers, movie players, etc...)

No special requirements.

Laboratory experiments on the non-invasive estimation of soil wave speeds

Ho-Chul Shin[1], Shahram Taherzadeh[1], Keith Attenborough[1], and Richard Whalley[2]

[1]Department of Design, Development, Environment and Materials, The Open University, Milton Keynes, MK7 6AA, UK

[2] Rothamsted Research, Harpenden, Herts, AL5 2JQ , UK

The shear wave speed in soils has been used as an indicator to the soil stiffness which has a profound effect on plant growth. Such metrics for soil strength have been traditionally measured through invasive means: e.g., by analysis of extracted samples. We have been developing a novel acoustic-seismic technique involving only non-invasive measurements which can be eventually deployed in a field for the in-situ remote monitoring of soil structure and strength. As a proof-of-concept, we present the results of laboratory experiments for homogenous dry sand and two-layered sandy soils placed in a tray at an anechoic chamber. A loudspeaker was used to generate incoming sound, and the reflected sound and the subsequent vibration of the soil surface were recorded by microphones and a Laser Doppler vibrometer respectively. These data were used to deduce soil parameters such as P- and S-wave speeds and layer depth through an optimisation process which seeks to minimise the differences between the data and predictions of a numerical code for sound reflection and transmission at the surface of layered poroelastic soil model. Independent validation of the deduced wave speeds has also been conducted by means of a small-scale seismic refraction survey and a conventional time-of-flight analysis involving small buried piezoelectric discs. The results have demonstrated the feasibility of soil parameter estimation using the proposed non-invasive methodology.