Scale of fluctuation of cone tip resistance measured in a virtual calibration chamber using DEM

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ABSTRACT

Geotechnical Engineers are always interested to investigate and capture real behaviour of examined materials. Because of its density of sampling points, continuous probes such as the CPT are well adapted to characterize soil heterogeneity. This has led to a number of developments that use CPT-logs to obtain the parameters required for a random-field characterization of soil properties. Prominent amongst these parameters is the concept of scale-of-fluctuation (δ), a compact descriptor of the spatial variability of the property examined [1].

The use of 3D DEM analogues of real soils to calibrate "in situ" tests using Virtual Calibration Chambers (VCC) has been put forward as a practical alternative to costly laboratory tests [2]. However, to achieve manageable simulation times the discrete analogues are typically scaled up to sizes more typical of gravel than sand. An observed side effect of the scaled-up discrete material size employed in VCC models was to increase the fluctuation of the observed macro-response. The size of such fluctuation was shown to have a strong dependency on the cone to particle ratio [3].

In this paper we explore the spatial structure of the fluctuations appearing on the cone penetration resistance log. This is applied to a series of CPT, in a nominally homogenous VCC, in which the cone to particle ratio is varied. Scales of fluctuation are estimated and their meaning is discussed.

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