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An Overview of the Study of Acoustic Emissions in Soil Mechanics

Danny Xavier Villalva-León[1], Gonzalo García-Ros[1], Juan Francisco Sánchez-Pérez[2], Enrique Castro-Rodríguez[2], María Rosa Mena-Requena[2], Manuel Conesa[2]
[1]Mining and Civil Department/Universidad Politécnica de Cartagena
Paseo de Alfonso XIII 52, Cartagena, Spain
dannyxavier.villalva@edu.upct.es; gonzalo.garcia@upct.es
[2]Applied Physics Department/Universidad Politécnica de Cartagena
Paseo de Alfonso XIII 48, Cartagena, Spain
juanf.sanchez@upct.es; enrique.castro@upct.es; maria.mena@upct.es; manuel.conesa@upct.es

Extended Abstract

In recent decades, advances in electronics have made it possible to use increasingly complex instrumentation within the many disciplines encompassed by engineering and, specifically, in soil mechanics. Thus, both at the level of field measurements and at the laboratory level, a wide variety of classic instruments, such as strain gauges, force or interstitial pressure transducers, are being modernized, with the electronic nature becoming increasingly important to the detriment of the mechanics.

But, in addition to the electronic adaptation of these classic sensors used in soil mechanics, which allows for greater simplicity in data acquisition and subsequent computerized processing, in recent years a series of new techniques (in a more or less experimental phase) are being incorporated into the study of soil mechanics, to provide additional information, sometimes very valuable, to that obtained by classical methods. Within these new techniques is the study of acoustic emissions produced in soils when they are subjected to loading processes or imposed displacement.

Based on this technique, scarcely studied to date, an investigation has been initiated that aims to characterize the acoustic emissions generated by soil grains when they are subjected to compression and/or shear processes. The investigations, which are being carried out at the Laboratory of Geotechnics of the Universidad Politécnica de Cartagena (UPCT), cover both coarse-grained soils (pure sand and sand with some gravel) and fine-grained soils (silt and clay). The study is extended for both saturated and unsaturated samples.

The challenge is complex, since the mechanisms that generate acoustic emissions in soils subjected to load or displacement processes are varied, the main ones being [1]: i) reorganization of grains contact points, ii) movement of the liquid or the liquid-gas interface, iii) intergranular friction and iv) crack formation. In principle, the characteristics of the acoustic emissions will differ [2] from one mechanism to another, so that the detailed study of these can provide information, complementary to that obtained by the classical methodologies in soil mechanics, which is very valuable.

The final objective of the research is to establish correlations between the compressibility and shear parameters of the soil (obtained by classical methodologies) with the parameters (amplitude, frequency, energy, among others) that characterize the acoustic emissions generated by the grains of soil during the settlement and failure processes. The results could allow using the acoustic emissions technique to identify mechanical precursors associated with potential landslides or other types soil failure.

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