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Design and implementation of a low-cost multichannel seismic noise recorder for array measurements

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Soil characterization is the starting point for seismic hazard studies. Currently, the methods based on ambient noise measurements are very used because they are non-invasive methods and relatively easy to implement in urban areas. Among these methods, the analysis of array measurements provides the dispersion curve and subsequently the shear-wave velocity profile associated to the site under study. In this case, we need several sensors recording simultaneously and a data acquisition system with one channel by sensor, what can become the complete equipment unaffordable for small research groups.
In this work, we have designed and implemented a low-cost multichannel ambient noise recorder for array measurements. The complete system is based on Arduino, an open source electronic development platform, which allows recording 12 differential input channels simultaneously. Besides, it is complemented with a conditioning circuit that includes an anti-aliasing filter and a selectable gain between 0 and 40dB. The data acquisition is set up through a user-friendly graphical user interface. It is important to note that the electronic scheme as well as the programming code are open hardware and software, respectively, so it allows other researchers to suite the system to their particular requirements.
The developed equipment has been tested at several sites around the province of Alicante (southeast of Spain), where the soil characteristics are well-known from previous studies. Array measurements have been taken and after that, the recorded data have been analysed using the frequency-wavenumber (f-k) and the extended spatial autocorrelation (ESAC) methods. The comparison of the obtained dispersion curves with the ones obtained in previous studies shows the suitability of the implemented low-cost system for array measurements.