

## **Preliminary characterization of seismic response in wide areas by using PCA analysis of HVSR data**

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In the last years a huge amount of HVSR (Horizontal to Vertical Spectral Ratios) measurements was performed and collected in Italy after the most damaging earthquakes (L'Aquila earthquake in 2009 and Emilia Romagna earthquake in 2012) and in the framework of the Seismic Microzonation studies involving a number of municipalities all over the country. These measurements firstly aim at the extensive seismic characterization of the study area by identifying sub-areas where analogous seismic response is expected in the case of future potentially damaging earthquakes. In particular, seismic resonance phenomena are of main concern and HVSR measurements may detect the eventual presence of sharp seismic impedance contrasts in the subsoil, also providing rough indications about the depths where these contrasts are located and their relative importance. In this context, availability of automatic procedures for classifying HVSR curves may be of great help when data concern tens to hundreds of sites.

The aim of this work is to investigate this issue by using the Principal Component Analysis (PCA). A main advantage of PCA is that it allows the grouping of sites characterized by similar HVSR curves by also identifying the relevant 'characteristic' HVSR pattern. In the frame of PCA, each HVSR curve is considered as a linear combination of patterns and at each site one or more of some of these patterns dominate (principal components). Selection criteria have been set that may optimize the partition of the data set in the view of the final application. Feasibility of this approach has been checked in three contexts in Central-Northern Italy, each characterized by different levels of geological complexity.