Session Computational seismology

SOILS VIBRATING, DETERMINISM OR CHAOS?

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The aim of the investigation is to evaluate the complex oscillatory behavior of soils structures under seismic excitation. The traditional mathematical models associated with the analysis of earthquakes are mostly linear and may fail to describe and to forecast behaviors because in many cases the data they model may be highly nonlinear and multifaceted. In this paper the implementation of Chaos theory for seismic time series analysis is presented. The tool, Recurrence Plots RPs, enables recognition and treatment of measured accelerations. The nonlinear attributes from RPs analysis can be used as filters to reveal patterns in the vibration of soils.

In the present paper, Part I, we show the theoretical approach and how it allows us to capture the *true* oscillations (deterministic, chaotic or both) and in Part II the soils dynamic response is categorized using the vibration period obtained directly from the accelerations registered. A *natural* period with a route to chaos seems to emerge from our considerations.

An important contribution of this study is the possibility, by means of RPs, of identifying i) materials highly sensitive to initial conditions, e.g. small differences in directivity, fault mechanism or distance, yield widely diverging outcomes (accelerations) and ii) deterministic or "predictable" stratigraphies, it means, soils systems whose behaviors can be acceptably predicted. Even more interesting is the conclusion about the changes in the conditions of soils masses that could drive the system from determinism to chaos.