



**UNVEILING THE STOCHASTIC ATTRIBUTES OF GROUND ACCELERATION
TRIGGERED BY MINING-INDUCED SEISMIC EVENTS**

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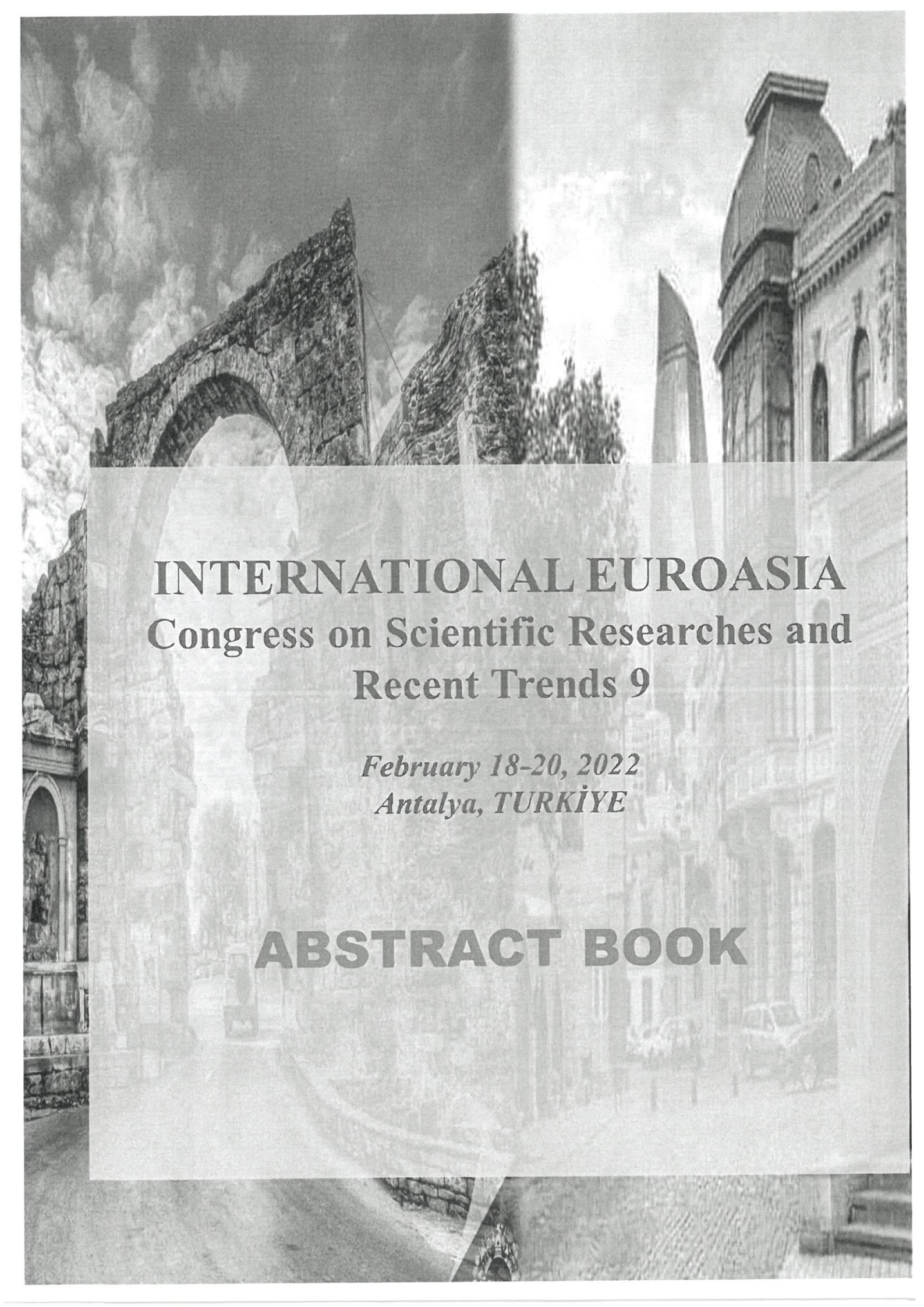
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ABSTRACT

In present paper it is shown that ground acceleration induced by deep-mining activities belongs to a group of stochastic processes, indicating low probability of prediction of the soil dynamics triggered by mining-induced seismic events. In particular, we analyze the seismic ground acceleration triggered by mining-induced seismic event $M=2$ recorded at the location of deep copper mine "Rudna" in western Poland in 2001. All three acceleration components are examined by invoking the series of techniques for nonlinear time series analysis: phase portrait reconstruction, Fourier spectrum calculation, surrogate data testing, mutual information method and false nearest neighbor method for determining optimum embedding dimension and embedding time interval, determinism and stationarity test with the determination of maximum Lyapunov exponent. The results of testing the dynamics of soil oscillations during mining-generated earthquakes indicated the nonlinear nature of the registered series, both north-south and vertical, while soil oscillations in the east-west direction belong to the class of stochastic processes with Gaussian distribution of stochastic part, which can be modified by some unknown nonlinear function. However, despite the fact that soil oscillations in the north-south and east-west directions belong to the group of nonlinear processes, the analysis of nonlinear time series showed that in these directions the soil oscillations also belong to stochastic processes. These results were confirmed by a low value of the deterministic factor κ (<1) and a low cross-prediction error in the stationarity test. Also, false nearest neighbor method did not give results in terms of determining the optimal embedding dimension, which again indicates the stochastic nature of the registered ground acceleration.

Keywords: mining-induced seismicity, nonlinear time series analysis, determinism, stochastic process



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