Abstract

The dissertation introduces a comprehensive analysis of the impact of the Kłodnicki Fault located in Upper Silesia Basin, Poland on the peak amplitudes of seismic vibrations recorded on the surface, generated by tremors induced by mining activity. The impact was determined using the methods of statistical inference concerning the study of changes in the regression coefficients of the Joyner-Boore ground motion prediction model, GMPE. The Joyner-Boore GMPE model is widely used to estimate seismic peak vibration amplitudes from both earthquakes and mining tremors. The dissertation discusses the basic regression parameters used to assess the impact of seismic vibrations caused by mining tremors on the surface objects and the method of their determination based on the Ground Motion Prediction Equations. Finally, it was demonstrated using the statistical Chow test that the coefficients of the regression model calculated for the recorded peak amplitudes of velocity and acceleration on the surface generated by seismic waves passing through the Kłodnicki Fault are significantly different from the coefficients of the regression model calculated for seismic waves not passing through this fault.

Therefore, the following thesis was formulated: The Ground Motion Prediction Model taking into account the passage of the seismic wave through the fault differs statistically significantly from the Ground Motion Prediction Model which does not take this phenomenon into account.

The thesis has utilized the method of multiple regression analysis and the Joyner-Boore Ground Motion Prediction Model with amplification coefficients. Based on the entire collection of recorded long-term seismometric data obtained from seismograms of high-energy mining tremors that occurred in the area of the Kłodnicki Fault in the Upper Silesia Basin, Poland in the period from 2006 to 2017, the coefficients of the Ground Motion Prediction Equations along with the coefficients determining the amplification effects caused by the subsurface geological layers were determined. In the next stage, the corrected peak velocity and acceleration amplitudes, reduced by the amplification factor, were determined. Then, the corrected seismometric data was used to estimate the coefficients of two Joyner-Boore Ground Motion Prediction Models without amplification effect. The first model included corrected seismometric data for which the seismic wave passed through the Kłodnicki Fault. The second Ground Motion Prediction Model included corrected seismometric data for which the seismic wave did not pass through the Kłodnicki fault. The division of the whole data set into these two

categories was possible due to the known location of tremor foci determined by mine seismological networks located in the area of the Kłodnicki Fault, Poland. Ultimately, the obtained coefficients for the two above Ground Motion Prediction Models were statistically verified by the Chow test, which showed that they are statistically significantly different from each other, thus proving the thesis.

The methodological solution presented in the thesis introduces a new method of analysis of seismic data in the regions of large fault zones, allowing for increasing the reliability of the assessment of seismic velocity and acceleration peak amplitudes and their impact on surface objects.