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Abstract of the doctoral dissertation

Methodology of interferometric data processing in the aspect of underground mining exploitation impact on the ground surface

Areas where underground mining is carried out are exposed to the occurrence of surface displacements. Due to the possible negative impact of underground mining on buildings, infrastructure and the natural environment, it is necessary to conduct geodetic monitoring of the surface in such areas. The development of modern measurement techniques (satellite and remote sensing) allows to perform measurements and acquire information in a short time, with high frequency and over a large area. However, especially in the case of measurements using remote sensing images, their accuracy depends on the spatial resolution of the pixel, as well as on the influence of external factors on the electromagnetic wave, which is the carrier of information.

The Author presents a methodology for processing interferograms based on Synthetic Aperture Radar (SAR) images, which allows to reduce the impact of external factors on the results of land surface displacement measurements caused by mining exploitation in the Legnica-Głogów Copper Belt (LGCB) area. Due to the nature of the observed movements (short- and long-term), the research works have been conducted according to the specific objectives described below.

Short- and long-term movements

To indicate the relevance of the effect of tropospheric delay on displacement measurements using Interferometric SAR (InSAR) techniques and to present possibilities for correcting this effect.

Short-term movements

Indication of the significance of the choice of statistical model in the unwrapping process of the SAR interferogram phase.

Fitting the subsidence to the theoretical curve - validation of the used methodology.

Long-term movements

Investigating the effect of spatio-temporal base selection on the measurement of long-term displacements using the Small Baseline Subset (SBAS) technique.

The proposed methodology, in terms of short-term displacements, enables a reduction of systematic errors and causes a decrease of dispersion of measurement results in the observed phenomenon. In the case of long-term movements, the presented methodology allows for selection of interferograms with the best quality for time series analysis and determination of relative measurement accuracy for a given pixel. The ability to determine the accuracy of measurement for a given area and to improve measurement accuracy will allow for a wider use of InSAR measurement data in the aspect of monitoring and forecasting of terrain displacements caused by underground exploitation.

The dissertation consists of 187 consecutively numbered pages. The dissertation contains references to 167 literature items, including 30 Polish-language items and 137 English-language items. The dissertation refers to 6 literature items, of which the Author is the lead author or co-author. There are 17 tables (including 1 in the appendix) and 74 figures (including 9 in the appendix) present in the dissertation.