

Fuzzy Expert Approach for Risk Mitigation on Functional Urban Areas Affected by Anthropogenic Ground Movements

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Abstract : A number of European cities are strongly affected by ground movements caused by anthropogenic activities or post-anthropogenic metamorphosis. Those are mainly water pumping, current mining operation, the collapse of post-mining underground voids or mining-induced earthquakes. These activities lead to large and small-scale ground displacements and a ground ruptures. The ground movements occurring in urban areas could considerably affect stability and safety of structures and infrastructures. The complexity of the ground deformation phenomenon in relation to the structures and infrastructures vulnerability leads to considerable constraints in assessing the threat of those objects. However, the increase of access to the free software and satellite data could pave the way for developing new methods and strategies for environmental risk mitigation and management. Open source geographical information systems (OS GIS), may support data integration, management, and risk analysis. Lately, developed methods based on fuzzy logic and experts methods for buildings and infrastructure damage risk assessment could be integrated into OS GIS. Those methods were verified base on back analysis proving their accuracy. Moreover, those methods could be supported by ground displacement observation. Based on freely available data from European Space Agency and free software, ground deformation could be estimated. The main innovation presented in the paper is the application of open source software (OS GIS) for integration developed models and assessment of the threat of urban areas. Those approaches will be reinforced by analysis of ground movement based on free satellite data. Those data would support the verification of ground movement prediction models. Moreover, satellite data will enable our mapping of ground deformation in urbanized areas. Developed models and methods have been implemented in one of the urban areas hazarded by underground mining activity. Vulnerability maps supported by satellite ground movement observation would mitigate the hazards of land displacements in urban areas close to mines.

Keywords : fuzzy logic, open source geographic information science (OS GIS), risk assessment on urbanized areas, satellite interferometry (InSAR)

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