Name and surname	Witold Rohm
Academic Degree	prof. dr hab. inż. (Prof.)
Institute/Department	Institute of Geodesy and Geoinformatics
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ORCID	0000-0002-2082-6366
UPWr Base of Knowledge - link	https://bazawiedzy.upwr.edu.pl/info.seam?affil=&id=UPWr4d682756bd1243c58f310f8e07f263af&lang=en&cid=1061108
Researchgate	https://www.researchgate.net/profile/Witold-Rohm
Personal website / Working group website	https://spaceos.igig.upwr.edu.pl
Participation in projects in last 5 years (chronological; with distinction into PI (kierownik) and RF (wykonawca))	2021 - 2025 NCN-OPUS Three-dimensional integrated observations of the troposphere using ground and satellite GNSS observations - PI 2020 - 2024 NCN-Preludium BIS Beyond machine learning in mobility prediction - PI 2019 - 2022 H2020, GATHERS - Integration of Geodetic and imAging TecHniques for monitoring and modelling the Earth's surface defoRmations and Seismic risk - Innovation and data manager 2017 - 2022 OPI - POIR, EPOS - European Plate Observing System - PI 2015 - 2019 NCBiR TANGO, GNSS tomography as an important meteorological data source - results comercialisation, PI
Do you plan to engage support of second supervisor or auxiliary supervisor?	No
PhD topic	**New Multi-dimensional Topological Data Structure for Vario-Scale Representation of Spatial Models**
Research discipline in Doctoral School	Civil Engineering and Transport
Short description of the research problem to be solved in the PhD (minimum 1000 characters)	3D models, such as building and city models, become available and widely investigated. They also become more detailed and complex. Analysis of such complex models, including spatial analysis, is currently possible with rapidly developing computing infrastructure. However, traditional methods for spatial analysis is an element, which lags behind the technical development. They are well described and widely used especially in Geographic Information Systems, but they are usually based on 2D algorithms and they are designed for single-processor computation. The biggest issue is to switch from a traditional approach to modern processing techniques offering much more computation power. Development of advanced tools dedicated to multi-dimensional modelling and analysis should bring not only better computation performance, but also quality improvement. The aim of this project is to develop a new multi-dimensional primal-dual topological structure for vario-scale representation of complex objects and comprehensive spatial analysis. To reach the aim the following objectives are specified: 1. To develop a new topological data structure for multi-dimensional model implementation. The fundamental concept behind it is primal-dual topology representation based on the Poincaré duality, which makes the structure unique. This also includes development of a set of tools for intuitive model construction and updates. 2. To develop a vario-scale modelling method, where connections among entities represented in a different scale are implemented as an additional spatial dimension. This requires development of a matching mechanism, which will identify and connect semantically the same entities from different data sets but represented in a different scale. 3. To perform spatial analysis on the multi-dimensional vario-scale model which is related to the smooth scale implementation. This requires development of a set of operators for model intersection with arbitrary surfaces.
Professional skills for PhD candidate (e.g. master program, specializations, softwares, language, analytical techniques, minimum 500 characters)	- Master degree in Computer Science, Geo-information or Spatial Information - Knowledge of 3D spatial modelling techniques and data structures - Good programming skills in Python, C++ or Delphi - Good writing skills in English - Scientific achievements will be an asset, e.g. publications, participation in research projects - Motivation to publish research findings in high-ranked journals and international conferences.
Details of the project to support PhD research	
a) Project title	New Multidimensional Data Structure for Vario-scale Spatial Model Representation
b) Agreement number	2021/41/B/ST10/03178
c) Number of months in the project to support PhD (in months; starting from 1st of October 2022)	36
d) Project website	