Name and surname:	**Krzysztof Sośnica**
Academic Degree	prof. dr hab. inż. (Prof.)
Institute/Department	Institute of Geodesy and Geoinformatics
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UPWr Base of Knowledge - link	https://bazawiedzy.upwr.edu.pl/info.seam?id=UPWrbd14633e36ae4108a4aefde1c1e25350&affil=&lang=pl
Researchgate:	https://www.researchgate.net/profile/Krzysztof-Sosnica
Personal website / Working group website:	http://www.igig.up.wroc.pl/igg/
Participation in projects in last 5 years (chronological; with distinction into PI (kierownik) and RF (wykonawca)):	Fundamental techniques, models and algorithms for a Lunar Radio Navigation system PI: prof. dr hab. inż. Krzysztof Sośnica (UPWr) Number (MSHE code): European Space Agency, ESA AO/1-10712/21/NL/CRS Duration: 7.10.2021 - 7.04.2023 Integrated terrestrial reference frames based on SLR measurements to geodetic, active LEO, and GNSS satellites PI: prof. dr hab. inż. Krzysztof Sośnica Number (MSHE code): National Science Center, UMO-2019/35/B/ST10/00515 Duration: 18.06.2020 - 17.06.2024 Determination of Global Geodetic Parameters using the Galileo Satellite System PI: prof. dr hab. inż. Krzysztof Sośnica Number (MSHE code): National Science Center, UMO-2018/29/B/ST10/00382 Duration: 2.01.2019 - 1.01.2022 General Relativistic Effects in the orbits of Galileo Satellites PI: dr hab. inż. Krzysztof Sośnica, prof. uczelni Number (MSHE code): European Space Agency, ESA Contract No. 4000130481/20/ES/CM Duration: 1.04.2020 - 1.03.2021 Innovative Methods of the Troposphere Delay Modeling for Satellite Laser Ranging Observations PI: prof. dr hab. inż. Krzysztof Sośnica Number (MSHE code): National Science Center, UMO-2015/17/B/ST10/03108 Duration: 15.02.2016 - 14.02.2020
PhD topic:	**Multi-GNSS solutions with stochastic clock modeling**
Research discipline in Doctoral School	Civil Engineering and Transport
Short description of the research problem to be solved in the PhD (minimum 1000 characters):	The main tasks of Global Navigation Satellite Systems (GNSS), such as GPS, GLONASS, Galileo, and BeiDou, include the determination of the receiver position, velocity, and timing. The International GNSS Service (IGS) was established with the aim to provide high-quality GNSS orbit, clocks, earth rotation, troposphere, and ionosphere parameters, and to realize the GNSS-based international terrestrial reference frames. So far, standard approaches to GNSS precise point positioning (PPP) assumed that the clock parameter is independent for each observation epoch. Moreover, in multi-GNSS solutions, clock parameters are separately estimated for each system involved: GPS, GLONASS, Galileo, BeiDou due to inter-system biases. This approach deteriorates the GNSS solutions because the clock parameter is strongly correlated with the station vertical coordinate component and troposphere zenith delay. The goal of this project is to improve multi-GNSS positioning by stochastic receiver clock modeling especially for those receivers which are connected to ultra-stable atomic clocks. Most of the IGS stations employ internal temperature compensated crystal oscillators. However, some stations are equipped with external clocks, such as rubidium, cesium atomic clocks, or hydrogen masers, which guarantee high-frequency stability. The receiver atomic clocks are used for the time transfer or realization and distribution of the Coordinated Universal Time (UTC). Modeling the receiver clock parameters provided by a stable oscillator improves the GNSS solutions, particularly, the up component in the kinematic positioning. This project aims at improving the static and kinematic multi-GNSS positioning by introducing clock models to the Kalman filter in PPP as well as relative constraining between adjacent observation epochs assuming the derived noise level for the random walk process. The kinematic PPP solutions will be introduced for ground-based GNSS receivers as well as the space-borne receivers installed onboard low Earth orbiters (LEO). We will employ new satellite missions, such as Sentinel-6/Jason-CS, which are capable of tracking Galileo signals. Therefore, we will exploit, for the very first time, the full advantage of the Galileo satellites equipped with ultra-stable clocks, as well as new Galileo services, such as High Accuracy Service (HAS) for novel PPP algorithms with relative clock modeling.
Professional skills for PhD candidate (e.g. master program, specializations, softwares, language, analytical techniques, minimum 500 characters):	Completed master's studies in the field of engineering and technical sciences or exact and natural sciences, e.g. geodesy, computer science, physics, mathematics, astronomy, space and satellite engineering or a related discipline, Proficiency in programming in a selected language (e.g. C ++, Perl, Fortran, Python), Experience in advanced data analysis or numerical modeling (confirmed by scientific articles or thesis), Scientific achievements, including publications or speeches at scientific conferences, will be an additional advantage, Fluency in English (spoken and written), Ability to work independently in a defined time regime, to present complex results in international forms in a concise and accessible way.
Details of the project to support PhD research:	
Project title:	Sonata BIS "EArth's Gravity fieLd Evolution (EAGLE)"
Agreement number:	UMO-2021/42/E/ST10/00020
Number of months in the project to support PhD (in months; starting from 1st of October 2022):	40
Project website:	