Oleksii Padun

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Graduate Research Assistant – Worcester Polytechnic Institute

Summary

Passionate and experienced spacecraft control engineer and astrodynamicist. Expertise includes spacecraft dynamics and control, orbital mechanics, and satellite testing. My PhD research focus is on spacecraft parameter estimation and control and uncertainty propagation. I have been involved in the design and development of the successfully launched CubeSat satellite (PolyITAN-30-HP, Kyiv, Ukraine). I Have deep orbital mechanics and simulation experience obtained during my Master's and during work on Spacebit's lunar mission. I have strong Machine Learning knowledge and experience with its applications for satellite estimation, control, and data analysis.

Simulations, Orbital Mechanics, Attitude Dynamics, Controls, Python, MATLAB, R, Machine Learning

Education

PhD in Aerospace Engineering | 2023 – Current
     Worcester Polytechnic Institute, Worcester, MA

Master of Science in Aerospace Engineering | 2021 – 2023
     Kent State University, Kent, OH

Bachelor of Science in Aerospace Engineering | 2017 – 2021
     National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Kyiv, Ukraine

Technical Skills

Computer Software

- GMAT, Ansys STK – Orbital Simulations
- MATLAB, Python, R, – Programming
- Simulink, LabVIEW – Control simulations and design
- SolidWorks, AutoCAD, Creo, COMSOL – CAD/CAE/CFD modeling

Mathematical Skills

- Orbital Mechanics
- Nonlinear Controls
- Kalman Filtering
- Optimization Algorithms
- Numerical computing
- Machine Learning Techniques
- Attitude Determination
- Monte Carlo Simulations
- Applied Statistics
- Linear Programming

Experience

Worcester Polytechnic Institute, Massachusetts   **September 2023 – Current**
Graduate Research Assistant

Nonlinear estimation and control theory. Numerical experiments of space-based systems. Dynamic parameter estimation and satellite dynamics research. Nonlinear Kalman filtering.
Key Skills: Kalman Filter, Attitude determination, Algorithm development, Optimization, MATLAB, Python, Statistical learning.

Kent State University, Ohio   **September 2021 – May 2023**
Graduate Research and Teaching Assistant at Space Systems Laboratory
Develop and test novel estimators and controllers and implement MATLAB scripts for Satellite Control. Setting up the testbed for **satellite dynamics** testing and research. The research included the development of the algorithm to automatically compensate the gravity offset by moving the balance masses. The algorithm includes **attitude determination, noise filtering, and control** of the positions of the balance masses utilizing the Kalman Filter method.
Teaching assistant experience during "COMPUTER-AIDED MACHINE DESIGN" class. Experienced in lecture preparations, delivering information, and planning and defining the course contents.

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Key Skills: Kalman Filter, Attitude determination, Algorithmization and Programming, Optimization, MATLAB, Teaching Skills, Problem Solving, Analytical Mechanics, Machine Design, Strength of materials, Public speaking, Course organization.

Spacebit, London, UK   **January 2021 – July 2021**

Orbital Mechanics Engineer

Orbital simulations utilizing GMAT (NASA General Mission Analysis Tool). Trajectory **optimization**, Mission Analysis, Physics-based simulations. **Attitude estimations**. Providing calculations for optimal **remote sensing** of the lunar surface.

Key Skills: Orbital mechanics, Python, Celestial body dynamics.

Science and Space LLC, Kyiv, Ukraine   **September 2020- July 2021**

Chief Design Engineer

Satellite data analysis with the application in the agricultural sector. **Pattern recognition**. Development of a mini-magnetosphere system and artificial gravity system concept for the space station in heliocentric orbit. Management of research tasks.

Key Skills: Data analysis, SQL, Python, Tensorflow, Remote sensing, Feature Engineering, Geographic information systems, Magnetic field simulations, Electrodynamics, Time-Management.

National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Kyiv, Ukraine September 2020-July 2021.

Engineer

Development of the assembly units of the Magnetic field simulator **for nanosatellites orientation and stabilization systems** testing. Creating technological documentation. Setting up control of the simulator of external heat flows for nanosatellite thermo-stabilization system testing. Analysis of the satellite flight data.

Key Skills: Magnetic field simulations, MATLAB algorithm developing, Control systems developing in Simulink, Attitude determination, Spacecraft Design.

Publications

[1] **Padun, O.,** Lu, Y. 2024. "Estimation and Control of Dynamic Mass-Moment Parameters for Spacecraft Attitude Simulator" *Proceedings of the AIAA/USU Conference on Small Satellites*, Ground Systems, SSC12-X-07. https://digitalcommons.usu.edu/smallsat/2024/all2024/119/

[2] **Padun, O.**, Serhieiev, D. V., Lysiuk, I. R., Kovalenko, I. Y., and Rassamakin, B. M., "Magnetic Field Simulator Control System for nanosatellites," *Microsystems, Electronics and Acoustics*, vol. 27, 2022. DOI: 10.20535/2523-4455.mea.242812

[3] Rassamakin, B., Ducheiko, M., Bayskov, N., Ostapchuk, S., Lauch, A., Lanevsky , E., Hominich, V., Tsybenko, A., Brykov , V., **Padun, O.**, "RESULTS OF DEVELOPMENT, MODELING, TESTING AND OPERATION OF THE POLYITAN SERIES NANOSATELLITES" *Space Research in Ukraine. 2018-2020,* 2021, pp. 115–123.

[4] **Padun, O.**, Klyuchnikov, Y., Horobets. O., Serditov, O., "Influence of Vanadium and Titanium on kinematics of growth and characteristics of strengthened with Boron surfaces.", *Youth Innovations in Mechanical Engineering: Igor Sikorsky KPI*, vol. 2, 2020, pp. 180-183, Accessible at: http://imm-mmi.kpi.ua/proc/article/view/202804/pdf_105

[5] **Padun, O.**, Klyuchnikov, Y., Serditov, O., "Influence of structure character on wear resistance of alloy steel", *Youth Innovations in Mechanical Engineering: Igor Sikorsky KPI*, vol. 2, 2020, pp. 190-193, Accessible at: http://imm-mmi.kpi.ua/proc/article/view/203173/pdf_107

[6] **Padun, O.**, Kovalenko, Y., Rassamakin, B., Ostapchuk, V., and Pynchuk, A., "Developing and creation of ground testing simulator for orientation and stabilization system of PolyITAN nanosatellites," *Journal of Rocket-Space Technology*, vol. 27, 2019, pp. 125–130. DOI: 10.15421/451918

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[7] *Under review:* **Padun O**., Ye Lu, "Mass-Moment Parameter Estimation and Control of Reconfiguring Spacecraft in Attitude Testbed", 2024