IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Interactive Presentations - IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (IP)

Author: Mr. Nadir Atayev
Azercosmos, Space Agency of Republic of Azerbaijan, Azerbaijan

Dr. Mehman Hasanov
Azerbaijan Technical University, Azerbaijan

INTEGRATED ANALYSIS OF ATMOSPHERIC PERFORMANCE MODELS AND SYSTEM-LEVEL FUNCTIONAL TESTS FOR A NEW GENERATION OPTICAL COMMUNICATION NANOSATELLITE SEGMENT

Abstract

This article explores the potential of nanosatellites in Free-Space Optical (FSO) communication, with a specific focus on addressing challenges related to atmospheric condition parameters, as turbulence, cloud conditions and etc. and its impact over the performance of a nanosatellite equipped with a 3D optical switch in an FSO environment. Mathematical models were employed to analyze the probability-time behavior and atmospheric quasi-dynamic performance of the system.

The study aims to enhance the parameters of the FSO optical communication transceiver subsystem on CubeSat platforms. Results indicate that atmospheric turbulence significantly affects system performance, but the integration of an optical switch improves the reliability of the communication link. Additionally, the research proposes a new generation 3D optical switch to construct an optical communication network between nanosatellites and ground stations.

Building on the conceptual foundation of a previous manuscript, "CONCEPTUAL DESIGN OF A COMMUNICATION NANOSATELLITE MODEL WITH A NEW GENERATION LASER BEAM CONTROL AND ACTIVE TRANSPONDER SYSTEM" this abstract delves into an integrated analysis of atmospheric performance models and system-level functional tests for highly effective optical communication in the nanosatellite segment.

The nanosatellite's communication model integrates a state-of-the-art laser beam control and active transponder system, highlighting advanced capabilities in optical communication. The research evaluates the practical implementation and performance of these innovations, playing a pivotal role in simulating real-world conditions to comprehensively assess the nanosatellite's operational efficiency and reliability.

System-level functional tests yield insights into the nanosatellite's communication reliability and data transfer rates. The abstract details methodologies, findings, and improvement plans for future design and development phases, emphasizing lessons learned from the testing phase to enhance performance, robustness, and reliability in subsequent iterations.

Concluding with a thorough analysis of integrated results, the abstract sheds light on the nanosatellite's performance metrics and operational capabilities. A roadmap for future work outlines areas of continued research, development, and potential advancements in optical communication nanosatellite segments, emphasizing the commitment to addressing challenges and improving the reliability of FSO communication in low earth orbit using stable nanosatellite platforms.