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PROBLEMS IN THE SYSTEM ANALYSIS OF SPACE ACTIVITIES IN UKRAINE. ROCKET AND SPACECRAFT DYNAMICS AND CONTROL

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This paper overviews the main research results obtained from 2016 to 2020 at the Department of System Analysis and Control Problems of the Institute of Technical Mechanics of the National Academy of Sciences of Ukraine and the State Space Agency of Ukraine. The overview was prepared using the method of phenomenological analysis. The results of the system analysis of the trends in the use of space technologies in different areas of human activities are presented. Methods of draft space program evaluation and R&D program formation algorithms are discussed. Research results on the dynamics of spacecraft and components thereof are presented. The dynamics of tethered space systems and microsatellites is considered. Consideration is given to the world's trends in the development of space transportation systems, the features of their development in Ukraine, and the state of the art of the methodological basis of rocket/space hardware design in Ukraine. Recommendations on working out normative documents and lines of their refinement are given.

System analysis methods were considered and found their further development as applied to the space sector. A method of structural-parametric identification was developed for the problem of object simulation with a multidimensional output in the class of beta-autoregressive models, in which autoregression weight coefficient ratios are determined based on beta-distribution density functions. On principles of the group data handling method, a regularity criterion was constructed and studied for simulation in the class of beta-autoregressive models in conditions of quasi-repeated observations. Investigations were conducted into the analysis, synthesis, and operation optimization of systems of multilevel, intellectual, and network management under uncertainty. Methodological approaches to the development of symbiotic self-contained aerospace and transport systems were elaborated. A new technology was developed for the construction of surrogate models with the use of approaches on the basis of the synergy of subject field methods and cognitive technologies based on general scientific achievements. Part of the research results has found prectiual use at Yuzhnoye State Design Office.

Keywords: *system studies, spacecraft, guided rocket, design parameters, trajectory parameters, rocket flight control program, numerical methods of optimization, robust control systems, industrial orbital complexes, Earth remote sensing, tethered systems.*

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