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SPACE OPERATIONS SYMPOSIUM (B6)
New Operations Concepts, Advanced Systems and Commercial Space Operations (2)

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INTELLIGENT CONTROL SYSTEMS FOR AUTOMATED SPACECRAFT

Abstract

According to spacecraft control experience the identified contingency situations occur rather often during the support of flight programs and require their urgent handling. Therefore there is a need of developing the systems, methods and models for real time analysis and detection of current flight situations to provide higher level of reliability and efficiency of spacecraft operation. The goal of this work is development and verification of design for the structural construction of intelligent systems providing identification of occurring flight situations and making automated recommendations for corrective control decision making. Such systems are especially important for deep space missions where due to the long distance from a spacecraft to the ground stations the only variant of spacecraft control in the near real time is autonomous control with the use of artificial intelligence systems. During the development the approach was used based on the system analysis of large dynamic control systems and their complex optimization. It is reasonable to use universal elements – the knowledge base of flight situations and the inference engine according to the conducted analysis of alternate variants for intelligent systems design developed for task solution in different scientific and practical activities. The methodological novelty of research is the new structural construction of intelligent systems where with the use of traditional universal structural elements the unit of identification of flight situations and the unit of simulation and prediction of spacecraft operation are also used. The original methodical principle for making up the decision rules is proposed consisting in logical correspondence between current flight situations and command inputs on spacecraft. The designed systems along with the use for spacecraft control may be used for the solution of different tasks in the fields of machine-building, transport complex, aviation and others. The possibilities of flight situations identification and their forecasting included in the system provide high operational efficiency of intelligent technological cycles for control decision making. The use of such systems will provide considerable backup to raise the efficiency and reliability of spacecraft control, to improve the quality of flight programs fulfillment and to increase the lifetime of spacecraft. The obtained results may be used to develop different projects for exploration of near and deep space including those in the framework of international programs.