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ALGORITHM TO CALCULATE THE TECHNICAL LEVEL OF A GEOSTATIONARY SATELLITE COMMUNICATION SYSTEM

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This paper presents a practical implementation (in the form of an algorithm and software) of the authors' methodological approach to assessing the technical level of a geostationary satellite communication system (GSCS).

The technical level index is a qualitative measure of the perfection of the GSCS design and the quality of the GSCS-provided services. The technical level is one of the key techno-economic indices of the GSCS development.

Together with the GSCS development and operation cost, the technical level index governs the GSCS competitiveness on the world market of space communication services.

The problem of quantitative assessment of the GSCS technical level is a complex multicriteria problem. Out of the many technical characteristics of a GSCS, only those that significantly affect the useful effect from its operation are chosen. To reduce the dimensionality of this problem, the many technical characteristics are divided into groups. Each group is a particular index of the GSCS technical efficiency.

The technical level calculation algorithm developed in this work is based on a mathematical model of Saaty's analytic hierarchy process extended by the authors to include mathematical models for accounting as fully as possible for the GSCS technical features and checking for errors and contradictions in the judgments of the experts who take part in the preparation of basic data on immeasurable or hard-to-measure techno-economic indices.

The operation of the algorithm is demonstrated using a numerical example.

Based on the calculated results, a conclusion is formed about the technical level of the GSCS under development in comparison with the world indices in the form of a linguistic variable.

Based on the algorithm presented in this paper, a state-of-the-art sectorial methodology for GSCS technical level quantification may be developed.

Keywords: *algorithm, technical level quantification, error check, spacecraft, analytic hierarchy process, space-rocket hardware, geostationary satellite communication system, technical level.*

1. Saaty T. Decision-Making - Analytic Hierarchy Process. Moscow: Radio i Svyaz, 1993. 278 pp. (in Russian).

2. Marchenko V. T., Petliak E. P., Sazina N. P., Khorolskyi P. P. Quantitative assessment of the technical level of space systems of Earth remote sensing and geostationary satellite communication systems. Teh. Meh. 2019. No. 4. Pp. 92-106. (in Russian).

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