

Project name: AP19679190 «Research and optimization of intelligent reflective surface technology using artificial intelligence»

Security features:

An intelligent reflective surface that allows you to control the wireless transmission environment is seen as a promising technology for improving spectrum and energy efficiency in future wireless communication systems. Previous work on the intelligent reflective surface is mainly based on the ideal phase shift model, since it summarizes the complete signal picture of each of the elements, regardless of its phase shift, but it is difficult to implement in practice. On the contrary, in this project, we propose a practical phase shift model that captures phase-dependent changes in the reflection coefficient amplitude over an element. Applying this new model to an intelligent wireless system with a reflective surface, we formulate the problem of maximizing the speed that it can achieve by jointly optimizing the transmission radiation and forming an intelligent reflective beam with a reflective surface. The formulated problem is difficult for optimal solution not only in the case of a convexity, but also in the general case, for which we propose a simple suboptimal solution based on the variable optimization method. The simulation results will reflect significant performance gains achieved by jointly optimizing beamforming based on the proposed phase shift model compared to the traditional ideal model.

Goals:

The goal of our project is that we present for the first time a practical model of phase shift both in Kazakhstan and around the world, and based on this model, we formulate and implement a new problem to increase the speed that it can achieve by jointly optimizing transmission radiation and intelligently forming a reflective beam on a reflective surface.

Expected results:

As a result of the project implementation, the following results will be obtained:

The results of research on optimizing the parameters of intelligent reflective surface technology are analyzed, methods for optimizing the parameters of intelligent reflective surface technology are analyzed, the application of special methods of physical optimization, signal encoding and processing is justified, and a program of technical requirements for communication technology is developed. The structure and scheme of a mathematical model for optimizing the parameters of intelligent reflective surface technology will be developed. An algorithm and program for optimizing the parameters of intelligent reflective surface technology are being developed. The results of research and optimization of parameters of intelligent reflective surface technology are obtained. An experimental mathematical model of an integrated antenna with optimized parameters of intelligent reflective surface technology has been developed. Recommendations will be developed for the use of optimization parameters for smart reflective surface technology parameters and optimization requirements. Completion form: Research report

Form: research report - in foreign peer-reviewed scientific journals: Science Citation Index Expanded, indexed in the Web of Science database and (or) in the Scopus CiteScore database 35 (thirty-five) in peer-reviewed scientific publications at least there are percentiles of at least 3 (three) articles and / or review; Science Citation Index Expanded, indexed in the Web of Science database or the Scopus CiteScore database of at least 35 (thirty-five) in peer-reviewed scientific publications, percentile, with at least 2 (two) or review articles; in addition, GZHBSSKK, submitted in peer-reviewed foreign or domestic publications of *olynda* at least 1 (one) article indexed in the Science Citation Index Expanded, and on the basis of Web of Science with an impact factor, 1 (first) or 2 (second), included in the quartile and (or) in the Scopus CiteScore database at least 65 (sixty-five) in peer-reviewed scientific publications with a percentile *i* of at least 2 (two) articles and (or) review; based on or Web of Science with an impact factor, 1 (first) or 2 (second) quartile of entries and (or) based on the Scopus CiteScore database of at least 65 (sixty-five) in peer-reviewed scientific publications with at least 1 percentile (two) articles indexed in the Science Citation Index Expanded, and based on or Web of Science with an impact factor of 1 (first), included in the quartile and (or) in the Scopus CiteScore database of at least 80 (eighty) percentiles are in peer-reviewed scientific

publications-at least 1 (one) article and (or) review; monographs, books and (or) foreign sections and (or) -1 are planned to be published in books published by Kazakhstani publishers. scientific and technical, design and public organization, development of tender documentation: not provided. dissemination of the results of the work among potential users, the scientific community and the general public: participation in the annual scientific conference of young scientists organized by the Science Committee; research results will be reported at international scientific conferences in the countries of near and far abroad; conducting regional, national and (or) international scientific and (or) research projects to continue research projects in the selected scientific direction; submission of applications for regional, national and (or) international competitions for the commercialization of research results; other measurable results.

During the research, at least 2 diploma projects and at least 1 master's thesis will be completed. It is planned to expand international scientific cooperation with leading universities of the world. The research laboratory for training extremely scarce specialists in the field of telecommunications, nanoelectronics and communications will work with new models of equipment, devices and software products.

The obtained scientific results can be used for the development of a new generation of communication: optimization and research of intelligent reflective surface technology 6) other measurable results.

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