SOVIET QUASIOPTICS OF THE MILLIMETER AND SUB-MILLIMETER WAVELENGTH RANGES IN THE HISTORICAL BACKGROUND

Need for the project. After more than a century of its history, the quasioptics (QO) has evolved into a specific branch of microwave science and engineering. Broadly speaking, this term is used to characterize methods and tools based on the optical principles however accounting for the wave diffraction. They have been devised for handling, both in theory and practice, electromagnetic waves propagating in the form of directive beams, whose width is greater than the wavelength however smaller than the cross-section size of the scatterers and waveguides. If compared with the classical optics of light, mm and sub-mm wave QO has certain characteristic features: here, electromagnetic waves fully display their coherency and definite polarization, they also show much greater divergence and diffraction, and eventually their direct amplitude and phase measurement is relatively easy. It is hard to find a publication where various historical aspects of QO are presented in complete manner, in comparative form, tracing the dynamics of development, and with an account of specific features of particular scientific problems and applications. As an early Western publication dealing with QO, one can consider the collection of papers presented at the *International Symposium on Quasioptics* held in New York in 1964. It was L. Felsen, one of the organizers of symposium, who should be credited for putting this term on a firm ground. Since then, several papers reviewed QO principles in major applications. In 1998, the IEEE Press printed a comprehensive monograph authored by P. Goldsmith, with a bibliography containing more than 700 titles. Here, the theory of the Gaussian wave beams has been presented in the most systematic way, together with corresponding QO components based on this important however not unique way of transmitting the electromagnetic power and designing various functional systems. However, all but a few of the referenced materials were of the Western origin. Starting from the early 1960s, active R&D into QO were undertaken in the USSR. It had a good background: one of the most important mm-wave pioneers was Piotr N. Lebedev in Moscow in the 1890's; later, magnetrons were under development in many civil and military laboratories in the 1920-1940s. As one can see, research into QO was done mainly in the laboratories of the USSR Academy of Sciences located in three cities: Moscow, Nizhny Novgorod, and Kharkov. It should be noted that the USSR microwave researchers had always a good access to the Western scientific literature however after the late 1930s almost never published their papers in international journals. Even if not classified, practically oriented papers had little chance to reach Western reader except of limited accessibility translations from the USSR journals. Participation in the conferences out of the USSR was virtually impossible. Therefore the proposed project is an attempt to review the little-known-of USSR QO technologies based on the various transmission lines and their numerous applications. The 1960s were the "golden age" of QO when the papers were published containing information on QO transmission lines of various types, and on the system design principles that corresponded to the available components. However, the USSR publications related to either a certain period or a certain research field or a particular team. Therefore a proper positioning of the accomplishments of the USSR scientists is still a subject of research. This study should be done against the background of the Western R&D, to show what was apparently copied and what was invented independently. It is also necessary to show major trends in R&D, and to emphasize the basic books, papers, and reviews in this field both in the West and the USSR.

Project objectives. The aim of the project is to prepare a compehensive review of the research and development into quasioptics of the near-mm and sub-mm waves in the former USSR, traced against the background of the general global trends and developments of the 1960-1980s.

Expected outcomes. The history of a continuous (non-periodic) QO hollow-dielectric beam waveguide developed in IRE NASU, Kharkov in the 1960s will be summarized in a feature article for the *IEEE Microwave Magazine*, "Early quasioptics of near-mm and sub-mm waves in IRE-Kharkov, Ukraine: from ideas to the Microwave Pioneer Award". In broader sense, this material will be also used to write a chapter for the book "Historical Evolutions of Wireless".