On the 70th Birthday of corresponding member of the Russian Academy of Sciences Victor A. Soifer

Sokolov V.O.

Samara Scientific Center of the Russian Academy of Sciences

Abstract. The article briefly tells about the life and scientific work of professor, doctor of Technics, corresponding member of Russian Academy of Sciences Victor Aleksandrovich Soifer - an outstanding scientist in the field of diffractive optics and computer image processing. I analyze the jubilee contribution to the development of photonics, computer optics and image analysis systems.

Keywords: computer optics, diffractive nanophotonics, analysis and understanding of images, nanoscale images processing, optical computing.

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Introduction

June 18, 2015 we celebrated 70 years since the birth of the outstanding scientist, teacher, public figure, scientific director of the Image Processing Systems Institute of the Russian Academy of Sciences (IPSI RAS), the president of the Samara State Aerospace University (National Research University) (SSAU), head of the Technical Cybernetics Department of SSAU, doctor of Technics, of the professor, corresponding member of Russian Academy of Sciences Viktor Aleksandrovich Soifer.

I talk in the article about the life and scientific results of the jubilee, analyzing V.A. Soifer's contribution to the creation of a new direction in science – computer optics.

Milestones

Victor Soifer graduated in 1962 with honors from school and enrolled at the Radio Engineering Department of the Kuibyshev Aviation Institute (KuAI, now - Samara State Aerospace University). He graduated with honors studies in KuAI in 1968. In 1968-1971 years he was trained in postgraduate KuAI on specialty "Theoretical radio engineering" and in 1971 in St. Petersburg Electrotechnical Institute of Communications defended his thesis "Modeling of the generalized Gaussian channel for analysis and synthesis of information transfer" for the degree of candidate of Technics. At the same time, from 1968 to 1971 he worked part-time as a junior

researcher KuAI. The results of the thesis formed the basis of the monograph [1]. After defending his thesis in 1971, V.A. Soifer worked in KuAI as senior researcher, from 1971 to 1973 he was an assistant, from 1973 to 1974 he was senior lecturer, in 1974-1981 he was assistant professor. In 1975, he received a certificate of associate professor of Automated Control Systems (ACS) department, and worked as the dean of the Faculty of Computer Science KuAI from 1975 to 1983.

Fig. 1. – Doctor of Technics, Professor, corresponding member of the Russian Academy of Sciences, Victor A. Soifer

In 1979, V.A. Soifer defended his doctoral thesis on "Restoring the fields parameters of automation systems for experimental studies" at the St. Petersburg Electrotechnical Institute. V.A. Soifer included some of the dissertation results in the monograph [2]. In 1981 he received a degree of Doctor of Technical Sciences, and in 1982 - a certificate of professor of ACS department. In 1982 he organized the Department of Technical Cybernetics in KuAI, headed it up to the present time. In 1988, V.A. Soifer organized and became the director of the Samara branch of the Central Design Bureau for Unique Instrumentation (CDB UI) of the USSR Academy of Sciences. In 1993, Samara Branch of CDB UI was reorganized into the Image Processing Systems Institute of the Russian Academy of Sciences (IPSI RAS). Until January 2015, V.A. Soifer superbly worked as director of IPSI RAS. In January 2015, V.A. Soifer was elected as the scientific head of IPSI RAS. From 1990 to 2010 he worked as the rector of Samara State Aerospace University [3]. From 2010 to the present time he is working SSAU president. Under the leadership of V.A. Soifer SSAU got the status of the national research university.

Scientific direction

V.A. Soifer created the theoretical foundations of computer optics – a new trend in information technology and optical system having a global priority. He and his disciples decided inverse problems of diffraction theory, developed iterative methods of optimization and synthesis, by computer based on the use of micro and

nanotechnologies created diffractive optical elements for transformation of laser light: the focus given geometric area, selection of transverse modes, the forming self-replicating beams. Together with his team, he studied the fundamental problems in the analysis and understanding of optical images, opto-information technology with practical applications in aerospace technology, medical diagnostics and geographic information systems. He prepared 16 doctors and 25 candidates of sciences. From 1996 to the present scientific school headed by V.A. Soifer received state support as the leading scientific schools of Russia in the field of computer optics and image processing.

Scientific results

The first scientific article by the student V.A. Soifer in collaboration with the student B.A. Esipov was published in 1967 in a collection of student research papers KuAI. It was called "The accumulation of information by repeating" [4]. It presents a method of reducing the loss of information that is transmitted in discrete binary Gaussian channel with losses.

In 1973, V.A. Soifer introduced spatial variable in the description of the generalized channel [5]. In this article, radio communication was treated as a multipath propagation environment. Even more clearly the analogy between the time radio channel and a coherent optical system, he wrote with D.D. Klovsky [6]. In this article, the authors used the optimum Karhunen-Loeve decomposition and the finite size of the antenna (this is the ultimate in optics as aperture) is considered an expansion in prolate spheroidal functions.

In August 1980, V.A. Soifer and colleagues published the first work on the synthesis of the optical element, which solves a specific task. Therefore, in 2015 we celebrate 35 years since the birth of a new scientific direction - computer optics. In this first paper [6] Academician A.M. Prokhorov and Professor I.N. Sisakyan were coauthors of Prof. V.A. Soifer. Article [7] has been devoted to the geometrical optics calculation of compensators. Compensator is the optical element forming the given wavefront (wavefront of desired shape). The main thing in this work is that the calculation of the compensator was regarded as the inverse problem of the diffraction theory.

The first work on the calculation and synthesis of focusator in longitudinal segment was published in 1981 [8]. The title of this paper was sufficiently general and set the direction of research - "Focusing of radiation into a proper space domain with computer-generated holograms." In 1982 he published a work [9], which was synthesized by reflecting focusator in the ring for the CO2 laser. The shape of the reflecting surface of the focusator was a combination of a spherical lens and axicon.

The first work on the synthesis of spatial filters for the study of transverse mode composition of laser radiation was published in 1982 [10]. In this paper authors presented the amplitude mask for creating Laguerre-Gaussian and Gauss-Hermite modes. The next (1983) filters have already been synthesized in the form of two amplitude masks for Hermite-Gaussian modes (0,0) and (0,1) [11]. Experimental studies on the measurement of the power distribution over transverse modes in an optical fiber using the spatial filters have been carried out in [12].

In 1984 V.A. Soifer with co-authors published the key article [13], devoted to Bessel-optics. This work stands alone in the scientific heritage of V.A. Soifer, it has

great importance for optics. The authors proposed an optical element with a complex phase function and the argument of this phase function was a linear function of the polar angle (angular harmonic). The authors proposed the optical implementation of Hankel transform for the n-th order with the help of such diffractive optical element (DOE).

The above several papers [7 – 13] are the pioneer and define the main directions in the development of diffractive optics. Many other scientific papers on calculation and creation of diffractive optical elements and photonic devices [14 – 65] emerged based on these pioneering publications. Applying these elements and devices is relevant to solving the problems of advanced information technology and micromanipulation [66].

Community involvement and recognition

Teaching, research and administrative activities of V.A. Soifer combines with social work. He is a member of the editorial boards of scientific journals "Optoelectronics, Instrumentation and Data Processing", "Computational Technologies", "Pattern Recognition and Image Analysis (Advances in Mathematical Theory and Applications)", "Optical Memory & Neural Networks (Information Optics)", "Computer Optics" (Editor-in-Chief defining the main directions and development strategy [67]), "SPIIRAS Proceedings", "Bulletin of Samara Scientific Center of the Russian Academy of Sciences", "Bulletin of SSAU", "Mechatronics, Automation, Control", "Information and Communication Technologies". Victor A. Soifer is a member of the Interagency Council on award Prizes of the Government of the Russian Federation, the chairman of the three dissertation councils, a member of the expert group of the International Prize in Nanotechnology "RUSNANOPRIZE", a board member of the International Association for Pattern Recognition (IAPR), a member of the International Association of University Presidents (IAUP), an expert of the Russian Foundation for Basic Research and Skolkovo. V.A. Soifer is a member of the Academy of Engineering Sciences, member of the Academy of Quality Problems. He is the chairman of the Public Chamber of the Samara Region.

The country's leadership noted labor achievements of V.A. Soifer by several awards: the Order of Merit; "Order of Merit for the Fatherland» IV degree and III degree; medal "For merits in the All-Russia population census", and by titles: Honored Scientist of the Russian Federation; Corresponding Member of the Russian Academy of Sciences; winner of the State Prize of Russia in the field of science and technology for 1992; winner of the RF Government in the field of science and technology in 2007; winner of the RF Government in the field of education in 2010; winner of the first prize of the German Society for the Promotion of Applied Computer Science; winner of the Provincial Prize for Science and Technology; winner of the Governor of the Samara region for excellence in solving technical problems; Honorary Citizen of Samara Region.

Conclusion

In conclusion, I wish Victor A. Soifer good health, inexhaustible energy, ongoing scientific curiosity, outstanding disciples and new creative achievements for the benefit of our country and science!

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