PREFACE

It is not a secret or discovery that the majority of scientists believe (and for good reasons) that the next XXI century will be the age of optical systems and informational technologies. This tendency is now rather obvious. The optoelectronic systems have been progressing most rapidly in the last two decades. Scientifically developed countries allocate significant funds to create such systems as well as to develop their applications.

An unceasing interest in solving the problems of constructing the up-to-date optoelectronic systems and increasing their efficiency is determined by a widening of the optics applications to the problems of information and energy transfer as well as imaging under conditions of real atmosphere. At the same time the methods and technology of adaptive correction need for the control means to overcome a decrease in the efficiency of the atmospheric optical systems caused by large-scale inhomogeneities of the refractive index of the propagating medium. Such inhomogeneities result from a turbulent mixing in the atmosphere and may appear in the channel of high-power radiation propagation due to molecular and aerosol absorption as well. The adaptive optical systems allow one:

– to enhance the laser radiation focusing at a target and to augment the intensity of a focal spot;

– to decrease blurring of astronomic and other object images constructed with telescopes; to improve the image sharpness, and to lower the probability of errors in the object recognition;

– to lower the noise level and to increase the rate of the information transfer in the optical communication systems.

Annual international conferences on the adaptive optics, organized by The International Society for Optical Engineering, and the adaptive optics sections in the programs of other conferences topically connected with the adaptive optics demonstrate that applicability of modern adaptive systems is a high-priority problem. In 1998 a specialized issue of the journal of the American Optical Society (*Applied Optics*, 1998, V. 37, No. 21) was published dedicated to the problems of adaptive correction of signals perturbed by the atmosphere. The specialized issue of the *Atmospheric and Oceanic Optics* comes out of the press every year.

In recent years the adaptive optics has found a wider application in astronomical telescopes. Russia also is working on its own project of 10-meter adaptive telescope ACT–10. In this connection, the investigation of the optical waves propagation through inhomogeneous media like the Earth's atmosphere is of a prime importance. Of special interest is the development of the theory and numerical methods for optical experiments. Solving of many problems requires the development of a comprehensive numerical model. It leads to a wider use of such investigation technique as *numerical experiment* based on solution of the initial differential equations.

It is well known that the first works connected with numerical simulation of beams and images perturbation in the atmosphere, and the possibilities of their adaptive correction refer to the early seventies. They have been being performed in parallel in several large laboratories in the USA. In 1977, the first specialized issue of the journal of the American Optical Society was published summarizing the results of theoretical and experimental works in the adaptive optics.

In the USSR the first works in this field began in the late seventies. Some results of these investigations were published in the specialized issues of the *Izvestiya Vysshykh Uchebnykh Zavedenii, Fizika* in 1983 and 1985 and in topical issues of the *Atmospheric and Oceanic Optics*, 1990–1997.

The present topical issue is devoted to investigation of the entire scope of these problems. It also includes the papers treating the theoretical problems of the optical waves propagation through stochastically inhomogeneous media. We hope that this issue will contribute to the process of widening the application of the modern optoelectronic systems.

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