Nonlinear photonics

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Nonlinear Photonics **(Eds.) H. M. Gibbs, G. Khitrova, and N. Peghambarian,** Springer-Verlag, Berlin, 1990. 210 p. (Springer Series in Electronics and Photonics. V. 30.)

The monograph provides a clear and consistent presentation of problems which arise in production and use of nonlinear optical devices for shaping, treatment, transmission and analysis of information, and also in their use for development of an optical digital computer and a neutrocomputer. In contrast to electronic systems light is used in these devices. In the five chapters of the book (Ch. II–VI) an analysis is presented of the present state of research in the fields of: 1) study of semiconductor nonlinear materials and their use for producing optically bistable elements—nonlinear devices with feedback (this is accompanied by results of research on physical processes which determine the origin of strong optical nonlinearities not only in bulk semiconductors but also in systems of quantum dimensions); 2) creation of optical interconnections (including holographic ones); 3) realization of the first digital optical computing circuits utilizing nonlinear devices; 4) use of photorefractive crystals for optical treatment of information and images; 5) creation of completely optical waveguide devices for ultrafast switching.

The editors have provided a successfully written first chapter of the book devoted to the prospects and problems of nonlinear photonics and unifying the whole book. An analysis is given of the causes responsible for the fact that, in spite of all the successes achieved during the last 15 years in the study of new nonlinear materials, and the invention of original devices allowing one to carry out logical operations and rapid switching in the optical range, the development of an optical computer and nonlinear optical devices for photonics is moving forward only slowly. The necessity is noted of searching for media with greater values of nonlinearities and for optimization of bistable devices with the aim of obtaining a considerable differential amplification of signals (the problem consists of the fact that it falls off sharply when the duration of the exciting light pulse approaches the relaxation time of the nonlinearity). The difficulty is also noted of utilizing for cascading logical devices carrying out the NOT–OR operation (the different wavelength of the input and output signals), etc. The authors express the opinion that nonlinear photonics can influence the development of ultrafast computers first of all as a result of creation of ultrafast processors and switching devices.

Readers interested in the problems of creation of an optical computer, of electronics and optoelectronics, and of nonlinear optics, will doubtless find much useful material in this well-written and excellently illustrated book.

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