电视影像在声光激光系统上的形成

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Introduction

The creation of devices capable of displaying a large amount of information with high quality of the reproduced image is of practical interest in such areas of science and technology as optical processing of information, recording information on various types of media, the reproduction of television images, communication and others where we are dealing with large flows information in real time.

At present, great efforts of the leading electronic companies of the world are aimed at creating television systems for displaying information using laser light sources. Lasers provide high brightness and color contrast in the image, unattainable for lamps and phosphors. Among the laser sources, pulsed lasers are emitted, which allow the effective nonlinear conversion of radiation to other parts of the visible spectrum and, thus, cover the entire wavelength range available for visual perception. One of the promising methods of real-time imaging for these lasers is the pulse image projection method of an amplitude-modulated ultrasonic line that fills the aperture of the acousto-optical modulator.

In the modulation method under consideration, there is no high-speed scan in a row, and, unlike existing methods that use matrix modulators, there is no discrete structure in the image. It is formed in real time without delay and is better consistent with a consistent way of transmitting information over the communication channel. Image dimensions can easily be transformed without modifying the modulation devices themselves. When recording information on various types of media, it is possible to perform coherent optical processing of this information. The possibility of using fully acousto-optical control devices for the system under consideration makes it possible to reject for a number of problems such mechanical control devices as mirror scanners, polyhedral rotating prisms, matrices, and micromirror lines. In addition, crystal media used for modulators can withstand large average and pulsed laser radiation powers, which

makes it possible to use the systems in question for technological purposes.

Despite the fact that the impulse imaging method has been known for a long time, there are many unresolved issues related to the efficiency and quality of image formation with the most effective acousto-optical modulators (AOM) on a paratellurite (TeO_2) crystal with amplitude modulation of ultrasound. The complexity of the problem lies in the fact that acousto-optical diffraction must be considered for an anisotropic gyrotropic medium, which is a TeO_2 crystal, and for an intermediate mode of diffraction of light by sound. The question of the prospects of practical application of this method for displaying full-colour television information on large screens in the high-definition standard is unclear.

Of great importance is the question of optimizing the output parameters of the laser for the purpose of imaging by the pulsed method. A copper vapour laser can be chosen as such a source, which remains one of the most powerful sources of light in the visible region of the spectrum and, in its output characteristics, agrees quite well with the requirements for a pulsed imaging system. In Russia, work is continuing to improve these lasers in the direction of increasing pump efficiency and practical efficiency.

The aim of the authors' research is the development of the theory of acousto-optical interaction for anisotropic crystalline media possessing gyrotropic properties and on its basis the development of a technique for calculating the spatial distribution of the intensity of light radiation on the projection screen during the diffraction of pulsed laser radiation by an amplitude modulated ultrasonic signal in a paratellurite crystal (TeO_2).

The study of the characteristics of an acousto-optical system with a pulsed method of forming a line for displaying and recording information using copper vapor lasers makes it possible to extend the results obtained by the authors to systems using full-colour pulsed solid-state lasers, which are now rapidly developing.

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