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Periodically non-homogeneous acoustic beams and their application in acousto-optics

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Light diffraction by ultrasonic waves is of great interest in the view of both fundamental physics and diverse applications. Acousto-optic devices are used for modulation of optical wave parameters, for optical information processing in real time, etc. In the given research, basic attention has been focused on the analysis of characteristics of anisotropic acousto-optic cells in which acoustic waves are excited by means of a phased array of transducers. Current technology makes it possible to create easily such transducers with antiphase excitation of adjacent elements of the array. The directional diagram of this composite transducer consists of several lobes whose spatial orientation varies with frequency. This peculiarity results in changing the Bragg condition. In the case of the anisotropic acousto-optic diffraction, every branch of the Bragg angle frequency dependence is split into several curves. This opens up new possibilities for optimization of acousto-optic devices. In this work, we have analyzed amplitude, frequency and angular characteristics of the phased transducer cells depending on crystal cut and transducer parameters. In particular, it has been shown that, in spite of a noticeable phase mismatch between interacting waves, the diffraction efficiency can approach 100%.