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# Calculation model of X-ray phase contrast image of tested structure

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The X-ray phase contrast imaging (PCI) method allows to visualize the internal structure of objects with small density gradients with high spatial resolution. The PCI technique is based on the use of the phenomenon of X-ray refraction, which leads to a change in the phase front of the wave that passed through the sample. As a result of such deformation of the phase front X-rays deviate from their primary direction at small angles, the magnitude of which depends on the spatial distribution of the density of matter in the object under study [1]. The phase shift of X-rays can't be measured directly, so it is converted into a intensity difference by specified ways that it can be detected. PCI technique can also be combined with tomographic methods to obtain a 3D-distribution of the refractive index in the sample.

In the presented research the calculation methods are considered for the diffraction result on the test structure. Each of sections of this structure changes the phase of the incident radiation in a specified manner. Due to the fact that Fraunhofer diffraction is observed at a considerable distance between source and screen, it is one of the limit cases of the scalar Kirchhoff diffraction theory. A one-dimensional case of diffraction was considered at first, where a linear phase change occurred within each of the lattice periods. As shown by the calculations for the phase lattice, the obtained intensity distribution differs qualitatively from the previously considered case of the amplitude lattice. Thus, one can see the displacement of the position of the central maximum distribution for case of a phase grating relatively the initial position. Due to this, the possibility is achieved for incident radiation concentrating in the chosen position. Graphs of intensity distribution for different indicator of linear phase change, as well as for different sizes of inhomogeneous section in the periodic structure of the phase lattice are calculated [2]. The peculiarities of the intensity distribution of diffracted radiation for such test objects are shown.

[1]. Paganin D. Coherent x-ray optics. Oxford University Press, 2013. 424 p.

[2]. Kolobrodov V.G. Applied diffraction optics: Handbook / V.G. Kolobrodov G.S,Tymchuk – K.: NTUU „KPI", 2014. – 312 p.

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