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### State-of-the art of the X-ray diffraction fractional optics theory: Matrix integral equations. The green function method

#### Abstract:

Up to now, developing theory of the X-ray diffraction by distorted crystals remains to be actual. The X-ray theory based on the equations with partial derivatives over the two coordinates within the X-ray scattering plane. In the report, the theory based on the first-order fractional X-ray diffraction optics equations with the fractional derivate of the order  $\alpha$  ( $0, 1]$  has been treated by using the Green function technique (GFT) and they have been converted to the matrix integral Volterra equation (MIVE) of the second kind. The theoretical approach has been elaborated in terms of the GFT. In the case when the incident X-ray beam strikes the crystal surface, the Cauchy problem can be cast in the form of the convolution of the matrix GF and the boundary-value function. In the case of imperfect crystals, the Liouville–Neumann-type series formalism has been applied to solving the Cauchy problems. The matrix Resolvent function solution explicitly has been built up. It has been shown that the fractional parameter  $\alpha = 1$ , the X-ray diffraction fractional optics equations have been formulated in the terms of the MIVE of the second kind. In some cases of the crystal-lattice defect field function (DFFs), Resolvent solutions of the Cauchy problem have been built up. To precise the parameter  $\alpha$  of the X-ray diffraction fractional optics is of fitting the theoretical model with observed 2D imaging data. One has discussed the problem of recovery of the Coulomb-type point defect in a crystal by computer X-ray diffraction technique.

#### Biography

**Felix N. Chukhovskii** has completed his PhD at the age of 24 years from Engineer–Physics Institute Moscow postdoctoral studies from Kurchatov’s Energy Institute Moscow. He is the leader scientist of Institute of Applied Mathematics and Automation KBSC RAS, Shortanov Str., 89A, Nal’chik 360000, Russian Federation. He has published more than 200 papers in reputed journals.