Polarization properties of Bessel-Gauss light beams

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In a reality, any light beams are limited in space. Therefore for non-diffractional light beams more realistic, though also more difficult, model is the Bessel-Gauss one, for which the cross distribution of amplitude of a field is described by product of functions Bessel of the first kind on Gauss function . In the present work the general vector solutions of the Maxwell equations and vector wave equation of Helmholz, describing Bessel-Gauss beams of light, are obtained. The new types of light beams with Bessel-Gauss cross-section structure of electromagnetic fields propagating in homogeneous isotropic medium are found. The complete solutions for all, including longitudinal, vector components of electric and magnetic fields are obtained. The polarization characteristics of various types of Bessel-Gauss light beams are found. Elliptically polarized modes are described. It has been shown, that azimuthal dependences of an electromagnetic field for linearly polarized modes are expressed more brightly. For circular modes azimuthal dependences of the field are disappearing and all expressions became simpler. It has been determined and analyzed the interrelations between various modes of nondiffractional fields in the cartesian and cylindrical systems of coordinates. The obtained results can be used at the description of mutual transformations of Bessel-Gauss light beams of various types.