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Deteriorated Quality of Phase Distorted Gaussian Beams SERGIY MOKHOV, LEONID GLEBOV, BORIS ZELDOVICH, CREOL - the College of Optics and Photonics, Univ. of Central Florida — The divergence of coherent optical beam is often characterized by the parameter M^2. For one transverse axis, this beam quality parameter is proportional to the product of the minimal observed beam size divided by the wavelength and multiplied by the divergence angle. Furthermore, M^2 is normalized such that its minimum value equals unity, which is achievable only by a Gaussian beam. An arbitrary phase distortion of a Gaussian beam increases M^2. Self-phase modulation is a common distortion in which the phase difference across the beam aperture is proportional to the beam intensity profile. For self-phase modulation, the deterioration of the beam quality parameter will depend on only one parameter, the phase at the center of the beam. We have found this dependence analytically. A general phase distortion profile can be represented by higher-order radial phase modes. We have also found the analytical dependence of M^2 in this generalized case. In addition, we derived expressions for beam quality deterioration of super-Gaussian beams due to phase distortions. If the waists of Gaussian and super-Gaussian beams are defined by a residual power criterion, which means both beams outside the same radius have the same amount of residual power, then a super-Gaussian beam will better tolerate phase distortions. It is important that all of our results cannot be efficiently reproduced by the traditional approach, based on the polynomial representation of aberrations, due to the poor convergence of power series for Gaussian profiles.

Sergiy Mokhov
CREOL - the College of Optics and Photonics, Univ. of Central Florida

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