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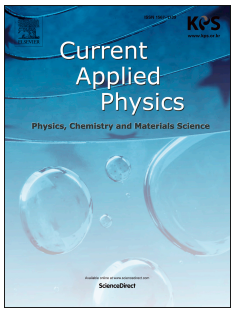

Z-scan analysis of elliptical Gaussian beams in Kerr media through the variational method: Toward integrative analytic solutions of Z-scan

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PII: S1567-1739(16)30361-3

DOI: 10.1016/j.cap.2016.12.009

Reference: CAP 4395

To appear in: *Current Applied Physics*

Received Date: 22 September 2016

Revised Date: 21 November 2016

Accepted Date: 9 December 2016

Please cite this article as: S.J. Lee, G.-H. Kim, Y.H. Mun, C.W. Sohn, K.H. Hong, H.D. Kim, J.S. Kim, C.H. Kwak, Z-scan analysis of elliptical Gaussian beams in Kerr media through the variational method: Toward integrative analytic solutions of Z-scan, *Current Applied Physics* (2017), doi: 10.1016/j.cap.2016.12.009.

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Z-scan analysis of elliptical Gaussian beams in Kerr media through the variational method: Toward integrative analytic solutions of Z-scan

Sang Jo Lee[a], Geun-Hyeong Kim[a], Young Hee Mun[a], Chang Won Sohn[a], Kwang Hee Hong[b], Hee Dae Kim[c], Jong Su Kim[a]* , and Chong Hoon Kwak[a]

E-mail: *jongsukim@ynu.ac.kr

[a] *Department of Physics, Yeungnam University, Gyeongsan, 38541, Korea*

[b] *Department of English Education, Yeungnam University, Gyeongsan, 38541, Korea*

[c] *School of Electrical, Computer and Energy Engineering, Arizona State University, Tempe, Arizona 85287, United States*

Abstract

Previous studies on Z-scan have paid little attention to Z-scan transmittance about elliptical Gaussian beams in thick Kerr media. The purpose of this study is twofold. First, it proposes a new analytical approach to the Z-scan on-axis transmittance for elliptical Gaussian beams through the variational method. The analytical approach yields an explicit analytical solution (not numerically analyzed solution) for the Z-scan on-axis transmittance in arbitrary thick media, and then the explicit solution is generalized to circularly or elliptically symmetric Gaussian beams. With the analytical solutions, we explain the mechanism of the elliptical beam waist changes in both positive and negative Kerr media. Second, the proposed solutions are experimentally tested in the photorefractive $LiNbO_3$:Fe crystal with a cw Ti:sapphire elliptical laser beam ($\lambda = 800\ nm$), showing congruence between experimental data and the predicted values from the solutions.

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