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Correlation study of real delay time and imaginary delay time in 1-dimensional weak disorder optical media PEEYUSH SAHAY, HUDA M. ALMABADI, PRABHAKAR PRADHAN, University of Memphis, TN, USA — Real delay time (τ_r) provides a measure of the time spent by photons inside an optical system. The measurement of τ_r is conducted in terms of energy (E) derivative of the Wigner phase delay (φ), as $\tau_r = d\phi/dE \propto d\phi/cdk$; k and c represents wavenumber and the speed of light, respectively. The characterization of τ_r requires interferometric system to measure φ of the light waves scattering from the medium $[R = \sqrt{r}\exp(-i\phi)]$. We investigated the possibility of extracting the τ_r information from the intensity measurement of the backscattered waves. The study was performed on a 1D model of weak disordered optical system and short sample length by numerically evaluating the backscattered light intensity. An imaginary delay time (τ_i), defined as $\tau_i = d\theta/cdk$, where θ represents an '*imaginary phase*', was obtained upon expressing the backscattered intensity as $RR^* = |R|^2 = r = \exp(-\theta)$. The result shows a strong correlation between r and φ; with τ_r and τ_i exhibiting similar statistical distribution but with a shift. The magnitude and variation of the mean and std values of τ_r, and the std values of τ_i with sample lengths are nearly the same, which indicates about one parameter theory of delay time. This work potentially paves way for extracting phase information from the intensity distribution without using interferometric systems.

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