ESTMATION OF ARBITARY REFRACTIVE INDEX DISTRIBUTION IN A ONE-DIMENSINOAL SEMITRANSPARENT GRADED INDEX MEDIUM

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ABSTRACT. Inverse estimation of refractive index distribution in an absorbing, emitting and scattering one-dimensional graded index slab is investigated. When the refractive index distribution does not have a sharp gradient, it can be fitted by a polynomial. This is the case which is considered here. So, the inverse analysis is reduced to estimation of the proper degree of this polynomial and its coefficients. The performance of three different approaches to estimate the arbitrary refractive index distribution is studied. In the first approach, the estimation is done from the knowledge of measured exit intensities at boundary surfaces by using the conjugate gradient method. Although these measured data are very suitable to retrieve the refractive indices at boundaries, but they can not recover the refractive index distribution inside the medium. The Levenberg-Marquardt method is used in the second approach to estimate the refractive index distribution from the knowledge of measured radiative fluxes inside the medium. Since the radiative fluxes inside the medium are more sensitive to refractive index distribution, then they are suitable quantities for estimation of refractive index distribution inside the medium. However, the problem is very ill-posed and the estimation is highly affected by the errors in measured data. To overcome this difficulty, a combination of two approaches is adopted where the refractive indices at boundary surfaces are obtained from the first approach and the refractive index distribution inside the medium is obtained by the second one. The results show that this approach can retrieve the refractive index distribution accurately even with noisy input data.