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AN ITERATIVE METHOD IN SOLVING AN INVERSE EIGEN VALUE PROBLEM FOR AN APPLICATION OF MULTIMODE OPTICAL FIBERS

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The purpose of this work is to derive two efficient algorithms for solving an inverse problem of current interest; it is the problem of determining the refractive index profile (as a main optical characteristic) of a multimode optical fiber having a circular cross section and a graded-index profile. Mathematically, this objective leads to solve an inverse Eigenvalue problem that consists in reconstructing the refractive index from a prescribed finite set of Eigen data (of the direct problem), knowing only the wavenumber in vacuum (the frequency). The numerical method (that converges geometrically and linearly) proposed in this work has been successfully introduced for estimating the exact refractive-index, and it can be extended in the same way to more similar or general cases: it can be extended to optical fibers of any refractive-index (not necessarily graded-index as we have seen in this work); can be extended to arbitrarily shaped optical fibers (the cross section may not be necessarily circular, it may be triangular, square, rectangular or even arbitrary); can be extended too to optical fibers of graded-index profile, but for any power parameter (which may not be an integer as it was taken in this work). The same numerical method adopted in this work can be proposed to solve other more complicated mathematical or physical problems. This work has produced a number of original and innovative ideas and results. The key achievements of this work are as follows: for the first time, a precise mathematical model has been given; two Algorithms have been designed, implemented, analysed and discussed; the algorithms are robust, that is to say: do not produce a wildly different result for very small change in the input data; this work has also presented extensive calculations to explain effectively the numerical information; many simulation studies were conducted to investigate the performance of the proposed method; numerical results were presented in the form of graphs and curves. Strictly speaking, much more hard and productive work will be required and expected to further the assessment and understanding of the promising obtained results and skills outlined in this work, which will be needed across future works

Biography

Hayat Rezgui is a Doctor of Sciences (in Mathematics). She currently works at the Department of Mathematics, École Normale Supérieure de Kouba (Algiers, Algeria) as a University Lecturer/Researcher. Her research is in Mathematical Physics, Optical Fibers, Multi-Resolution Analysis, Wavelets and Image Processing. She has several publications (in renowned journals) and conference papers. She has participated in many international conferences, meetings and events. She is serving as a Reviewer for privileged journals.

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