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Temperature dependent refractive index sensing in nanostructure engineered fibers

Abstract:

Nanostructured optical fibers have attracted significant research interest due to their relatively simple fabrication and design flexibility. This study presents a numerical investigation into the influence of various structural and thermal parameters on the refractive index and modal properties of nanostructured fibers. Key geometric factors such as air hole diameter, spacing (pitch), and the number of holes were analyzed. Results show that increasing the air hole diameter leads to an increase in the effective refractive index, while increasing the spacing between holes results in a decrease. Conversely, the number of air holes exhibits negligible influence on the refractive index. The effect of temperature on the refractive index was also examined. A direct relationship was observed: as temperature increases, the refractive index of the guided electromagnetic pulse also increases, indicating potential for temperature-based fine tuning of refractive index in active compensation systems. The analysis was carried out using the finite element method on fibers structured with a regular hexagonal crystal lattice, considering specific geometric configurations. The results provide insights into the design of temperature-sensitive fiber optic systems and sensors.

Biography

Rahul Hazare is a distinguished scholar at the Hindu University of America, Florida, recognized for his academic excellence and dedication to research. His work reflects a strong interest in the traditional knowledge systems of ancient civilizations, particularly in the fields of mathematics, astronomy, and architecture. Guided by his mentor, Dr. Ramesh S. Paranjape- a renowned scientist and former Director of the National AIDS Research Institute Dr. Hazare continues to advance his scholarly pursuits with a commitment to academic growth and innovation.