


Nov 7th, 3:00 PM - 4:00 PM

Genetic Algorithm Design of Photonic Crystals for Energy-Efficient Ultrafast Laser Transmitters

Troy A. Hutchins-Delgado
troyhutchins@unm.edu

Follow this and additional works at: <https://digitalrepository.unm.edu/skc>

 Part of the [Condensed Matter Physics Commons](#), [Electromagnetics and Photonics Commons](#), [Electronic Devices and Semiconductor Manufacturing Commons](#), [Nanotechnology Fabrication Commons](#), [Optics Commons](#), and the [Theory and Algorithms Commons](#)

Hutchins-Delgado, Troy A.. "Genetic Algorithm Design of Photonic Crystals for Energy-Efficient Ultrafast Laser Transmitters." (2018). <https://digitalrepository.unm.edu/skc/2018/posters/29>

This Event is brought to you for free and open access by UNM Digital Repository. It has been accepted for inclusion in Shared Knowledge Conference by an authorized administrator of UNM Digital Repository. For more information, please contact disc@unm.edu.

Genetic Algorithm Design of Photonic Crystals for Energy-Efficient Ultrafast Laser Transmitters

Troy A. Hutchins-Delgado¹, Alexandria Miera¹, Dominic Bosomtwi¹, Sami Nazib¹, Anthony R. James², John Nogan², Gennady A. Smolyakov¹, and Marek Osiński¹

¹Center for High Technology Materials, University of New Mexico, Albuquerque, NM 87106,

²Center for Integrated Nanotechnologies, Albuquerque, NM 87123

Abstract

Photonic crystals allow light to be controlled and manipulated such that novel photonic devices can be created. We are interested in using photonic crystals to increase the energy efficiency of our semiconductor whistle-geometry ring lasers. A photonic crystal will enable us to reduce the ring size, while maintaining confinement, thereby reducing its operating power. Photonic crystals can also exhibit slow light that will increase the interaction with the material. This will increase the gain, and therefore, lower the threshold for lasing to occur.

Designing a photonic crystal for a particular application can be a challenge due to its number of parameters and features of interest. A genetic algorithm evolves solutions around the constraints of the application until the fittest solution is found. We are optimizing our crystal structures to maximize their bandgaps. However, our designs are using dielectric materials to fill any holes which lowers the refractive index contrast and bandgap for a given design. Our unique approach is to integrate several materials and sample the various permutations within the genetic algorithm. Thereby, allowing for complex structures with larger bandgaps to arise. Here we present our successful preliminary findings that show a large complete bandgap can be achieved despite a relatively low index contrast.