NUSOD 2007 Short Course Description SC0703

Photonic Crystal Devices and Integrated Circuits

SCOPE: Photonic crystal structures offer the ability to engineer the electromagnetic properties of materials. They do so by creating a band of frequencies over which electromagnetic radiation is forbidden to propagate within the host material, these bands are referred to as "photonic bandgaps". As a result, these structures can be used to confine, route, suppress, localize, split, disperse, and filter electromagnetic waves. To this end, numerous useful and interesting devices can be realized. For this reason, the emphasis of this course will be on providing a working knowledge of the basic operational physics of photonic crystal devices and of mathematical and computational design methods for their simulation. Several examples targeted at integrated photonic systems will be covered.

BENEFITS AND LEARNING OBJECTIVES

- Understand the operation of photonic crystal structures
- Use the finite-difference time-domain method for 1-D, 2-D, and full 3-D simulation and analysis of photonic crystals
- Design photonic crystal circuits and devices, including low-loss waveguide channels, sharp bends, efficient splitters, super prisms, drop filters, 3-D routing, in- and out-coupling structures, and high-Q cavities

INTENDED AUDIENCE: This course is aimed at students, researchers, and working professionals. No previous familiarity with photonic crystal devices is necessary, but a general understanding of optical physics would be helpful.

COURSE LEVEL: Introductory

INSTRUCTOR: **Ahmed Sharkawy** is a Director of Photonic Applications at EM Photonics, Inc. He was a senior research and development engineer at W.L. Gore and Associates where he was a member in High Data Rate Signal Transmission (HDRST) team, where he developed advanced simulation tools for both time and frequency domain with an automated test procedure for various physical electromagnetic parameter extraction from actual lab measurements. He published over 40 technical papers, two of which were the cover articles for *Photonics Spectra* and *Applied Optics*, three book chapters, in the handbook of nanotechnology, a book to appear Fall 2008 and holds 15 patents. The focus of his Ph.D. was the area of design and analysis of photonic crystal and photonic bandgap devices and he has developed very novel and efficient numerical algorithms for their design.