Events

Current Events
Lectures
Events Archive

CCT Colloquium Series

Modeling of nanophotonic devices for manipulating light at deep subwavelength scale

Georgios Veronis, CCT and Electrical & Computer Engineering

Assistant Professor, Louisiana State University

Johnston Hall 338
April 25, 2008 - 11:30 am

Abstract:
Nanophotonics represents a new regime of optics. The development in this field is leading towards ultra-small and high-speed photonic and optoelectronic devices, which are important for a wide range of optical systems. In the development of nanophotonics, computational modeling has had enormous impact. The underlying physics of photonic devices are described by Maxwell's equations, which can be solved accurately using advanced computational techniques in many cases of interest. Therefore, modeling becomes predictive, regardless of preconceived notions, and can provide direct guidance in device design. Modeling also provides unique insights into the device operation through direct visualization of the underlying physical processes. In this talk we review some of our recent efforts in developing highly efficient algorithms for modeling nanophotonic structures, and in using them to develop new devices. The development of optical devices that confine and manipulate light at a deep subwavelength scale represents a new frontier in nanophotonics. Based on frequency-domain modeling, we introduce a new class of plasmonic waveguides consisting of a slot in a thin metallic film. Such a waveguide supports a truly guided mode, with a modal diameter of approximately 50nm at infrared wavelengths, a huge guiding bandwidth, a high group velocity, and a relatively long propagation distance. These characteristics are ideal for many applications in optical interconnect systems. For practical implementations of nanophotonic devices, it is of fundamental importance to determine the sensitivity of the device properties to variations of the design parameters. We present a new sensitivity analysis method based upon the adjoint variable method and a frequency-domain solver for Maxwell's equations. In this approach, once a device is simulated, the sensitivity of the device performance with respect to any number of design parameters is calculated with very small additional computational cost. Furthermore, this approach determines the sensitivity with respect to geometrical parameter variations accurately without the need for the use of high-resolution grids.

Speaker's Bio:
Georgios Veronis is an Assistant Professor jointly at the Center for Computation & Technology (CCT) and in the Electrical & Computer Engineering (ECE) Department at Louisiana State University. He received the Ph.D. degree in electrical engineering from Stanford University in 2002. His research interests include the theory and simulation of photonic materials and devices, nanoscale photonic devices, plasmonics, and computational electromagnetics.