Computational Mathematics Seminar Series

Plasmonics for Controlling Light at the Nanoscale: Cavity and Slow-Light Enhanced Devices, and the Effect of Disorder

Georgios Veronis, LSU

Assistant Professor, Electrical & Computer Enginering

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Abstract:
We review some of our recent work on plasmonic devices for manipulating light at the nanoscale. We first theoretically investigate the effect of fabrication-related disorders on subwavelength plasmonic waveguides. We use a Monte Carlo method to calculate the roughness-induced excess attenuation coefficient with respect to a smooth waveguide. We find that the excess attenuation is mainly due to reflection from the rough surfaces. However, for small roughness correlation lengths, enhanced absorption is the dominant loss mechanism due to disorder. We then show that a compact submicron structure consisting of multiple optical microcavities on both the entrance and exit sides of a subwavelength plasmonic slit can greatly enhance the absorption cross section of the slit. An optimized submicron structure consisting of two microcavities on each of the entrance and exit sides of the slit leads to an order of magnitude absorption enhancement compared to an optimized slit without microcavities. We finally introduce slow-light enhanced active plasmonic devices. We show that, as the slowdown factor increases, the sensitivity of the effective index of the optical mode to variations of the refractive index of the active material increases. This leads to active plasmonic devices with enhanced performance. Compared to conventional absorption switches, slow-light enhanced switches achieve significantly higher modulation depth with moderate insertion loss.

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

Refreshments will be served.
This lecture has a reception.

Center for Computation & Technology
2003 Digital Media Center • Telephone: +1 225/578-5890 • Fax: +1 225/578-8957