

Title: The light interaction with semiconductor and metallic materials: micro and nanoscale.

Abstract

My talk will be started with a brief explanation about the light propagation in micro bent waveguides. To study these structures, two models; a semi-analytical and a numerical were developed. The inclusion of the semiconductor optical properties through a quantic model allows the refractive index determination as a function of the semiconductor carrier's densities, frequency and temperature. I will provide a brief explanation about the coupling between two curved waveguides, and I will finish the first part of my talk with the inclusion of the semiconductor optical properties, in particular concerning the interaction between photon and carrier densities, on the signal to noise ratio.

In the second part of my talk, I will explain the light interaction with metallic materials with slits at a nanoscale. Nanotechnology is everywhere, and new devices are popping up every day, in particular, the nanoantennas. I will start to explain the light interaction with metallic materials with one slit and a group of slits. I will also describe the surface plasmon propagation along a dielectric/metal interface, which is fundamental to understand the extraordinary optical transmission (EOT) phenomenon. The electromagnetic wave classic diffraction theories of Fraunhofer, Fresnel, Kirchhoff, Bethe and Bouwkamp are also mentioned. Finally, the simulation of an optical antenna was performed with the consideration of the EOT occurrence.

The talk will be finished with some considerations about the inclusion of these emerging themes in a complete and coherent teaching/pedagogical program starting from undergraduate educational modules until postgraduate levels.

Short Bio



João Torres is currently an Invited Assistant Professor at the Instituto Superior Técnico in the Department of Electrical and Computer Engineering and a Researcher at the Instituto de Telecomunicações with the Group of Applied Electromagnetism (in the scientific area of Basic Sciences and Enabling Technologies). He earned his PhD in Electrical and Computing Engineering, in 2014. From 2016 until now he published thirteen international journal articles and nine international conference papers, participates in one international project (Eureka –Novel concentrating PV/T & T solar collector and automated production methods) and two national projects. One of them in collaboration with Academia Militar (Comunicações Táticas por IV

entre Viaturas Militares).

His expertise area includes: semiconductors and metallic materials, nonlinear optical properties; photovoltaic solar collector modulation and redesign and new Finite Element Methods for Engineering Applications.