Title: Numerical simulations of optical response of nanostructures using FDTD method

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Abstract: Abstract: The aim of this thesis is to develope an efficient algorythm to compute optical response of nanostructures and to equip it with usefull tools for further data processing. Considered problem is reduced to two dimensions and the method used is the Finite Difference Time Domain (FDTD). This method operates on finite grid called Yee grid and is often called Yee algorithm. En extra emphasis is given on optimalization of the algorithm and writing the computer code efficiently. Evolution equations are written in tensor form and the core algorithm is moved to graphic card using CUDA. Various boundary conditions are introduced to reduce reflections on the edge of the grid. Representation of a real object on the Yee-grid is discussed with introduction of several smoothing methods to improve the shape convergence of simulated object. Useful post-processing methods are introduced - discrete Fourier transform, from which the frequency response of simulated object can be computed and a way to compute the far field from the near field. Finaly, there is an attempt to simulate a surface plasmon.

Keywords: FDTD, CUDA, PML, CPML, Yee-grid