Contribution ID: **80** Type: **Poster Presentation**

Plasmon excitation in OLED with the DTMaxwell code

Monday, 11 July 2016 16:30 (1 hour)

Abstract content
   (Max 300 words)
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Verification of DTmaxwell code by simulation of OLED with corrugated cathode.

We have developed a Finite Difference Time Domain (FDTD) code DTMaxwell for General Purpose Graphical Processing Units (GPGPU) architecture with the use of Locally Recursive non-Locally Asynchronous (LRnLA) algorithms DiamondTorre [1].
Its performance was tested and good results were achieved on a desktop computer, as well as on many-GPU supercomputer.
This time, as a practical illustration of the advantages of our approach, we solve a large-scale problem of Surface Plasmon Polaritons (SPPs) excitation. SPP is excited by a point source placed in a close proximity (less than 100 nm) to a two-dimensional periodically corrugated metallic (silver) surface with a pitch of 400 nm. This problem is essential for simulation of SPP losses in both Organic and inorganic Light Emitting Diodes (OLEDs and LEDs) and design of OLEDs/LEDs with improved outcoupling efficiency. The simulation in question requires large meshes (>100GB of data) because of the large spatial decay lengths of SPPs (up to several tens of microns), whereas the mesh step should be kept sufficiently small (less than 5 nm) in order to account for strong field gradients at the dielectric-metal interfaces. Using this problem as a test case, we evaluate our code on different computers and compare to the previous solutions of such problem.

[1] Perepelkina A.Yu., Levchenko V. D., DiamondTorre Algorithm for High-Performance Wave Modeling // Keldysh Institute Preprints (2015) No. 18. 20 p.
[2] Sergei Belousov et al, Outcoupling efficiency of OLEDs with 2D periodical corrugation at the cathode, 2016 J. Phys. D: Appl. Phys. 49 085102

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Session Classification: Poster Session