Improved ASR convergence for the simulation of Surface Plasmon Waveguide Modes

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In order to simulate surface plasmon waveguide structures we have utilized and improved the adaptive spatial resolution technique and combined it with PML boundary conditions.

Summary

Convergence of the Fourier Modal Method for metallic structures is problematic, particulary in TM. One of the proposed techniques to increase convergence is adaptive spatial resolution. This consists of a parametric representation of the coordinate axis, which allows a spatially adaptive resolution, increasing the sampling in the neighbourhood of the discontinuities of the permittivity function[1]. The original technique was later extended to multilevel profiles [2]. We modified the parametric reformulation so the formalism could be used to provide reliable estimates for a two-stage method in a eigenmode solver (CAMFR [3]). PML boundary conditions were also integrated into the formalism. Four different possibilities for the parametric representation have been compared, of them, only one shows a dramatic increase in convergence in combination with PML.

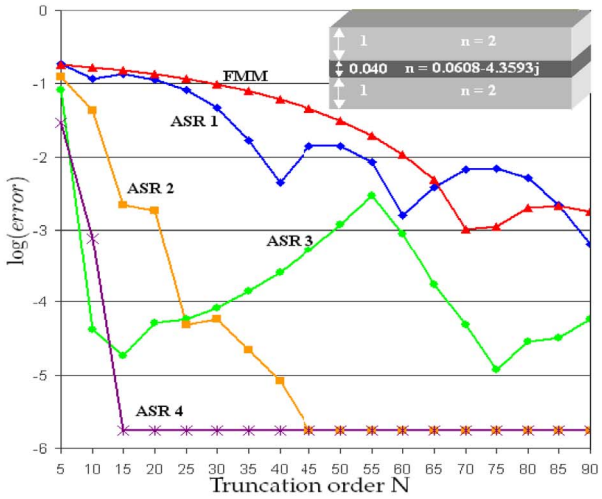

Fig. 1.: Convergence of the ASR methods, the setup is depicted in the inset of the figure.

We are currently working towards a 2D version of the adaptive spatial resolution algorithm.

References

[1] Granet G, *JOSA A- Optics Image Science and Vision* **16**(10): 2510–2516, 1999.

[2] Vallius T, Honkanen M,*Optics Express* **10** (1): 24–34, 2002.

[3] Bienstman P and Baets R, *Opt. Quantum Electron* **33**(4–5):327-341 2001.