How to Understand Time-Space Synchronized FDTD Algorithm

Part 5

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In part 2, 3 and 4 I explained one method of handling computing domain boundary when estimating a function derivative with nearest function values. In this part I want to remind readers that the method I explained in those parts is not for dealing with the boundary condition issue in a FDTD simulation.

A boundary condition scheme is to set function values at the computing domain boundary. For example, suppose a computing domain is $r_{max} > 0$

$$v(w\Delta s); w = 0, \pm 1, \pm 2, \dots, \pm r_{max}$$

If the boundary thickness is 1 then$\pm r_{max}$ are the computing boundary. A boundary condition scheme must specify function values

$$v(-r_{max}\Delta s), v(r_{max}\Delta s)$$

If the boundary thickness is 2 then$\pm r_{max}, \pm(r_{max} - 1)$ are the computing boundary. A boundary condition scheme must specify function values

$$v(-r_{max}\Delta s), v(-r_{max}\Delta s + \Delta s), v(r_{max}\Delta s), v(r_{max}\Delta s - \Delta s)$$

The TSS algorithm is independent of boundary condition schemes. That is, you can use any boundary condition schemes with the TSS algorithm.

Now back to our method of handling the computing boundary. Our “handling” is not to set function values as a boundary condition scheme does, it is to choose which function values to be used. All function values are known. The function values can be from the initial conditions, the boundary conditions, or by the previous estimations.

I hope now you see the differences clearly.