
Absorbing boundary conditions

This homework assignment concerns the implementation and usage of transparent boundary conditions based on complex-valued coordinates or an a perfectly matched boundary layer.

Note: For simplicity, this assignment is for one transverse dimension.

Deliverables:

- A) Select a beam propagation method that you have written previously, e.g. Crank-Nicolson in 1D, or the Method of Lines.
- B) Option 1:
Modify, or “move” the spatial computational axis into complex plane the way described in the class: The left and right end of the computational spatial grid has to deviate into lower and upper complex half-plane. This modification will ensure that all outgoing waves will decay in the boundary layer. Calculate the coefficients of the discrete Laplacian corresponding to your “complexified” grid, and use them to modify your original BPM method.
- B) Option 2:
Add to the discretized Laplacian the terms that realize the perfectly matched layer as described in the lecture notes.
- C) Set up a demonstration simulation similar to that we used in class, and show that your absorbing boundary can annihilate a beam propagating at an angle. Give an estimate of the residual (intensity) reflection from the domain boundary.