

This project consist in algorithm design and its implementation in a program. It concerns the ADI method and its application to a vectorial beam propagation.

**Project:** Create an ADI vectorial BPM simulator. Follow the optimized algorithm description in the attached paper, implement it in a program, and demonstrate its function in an illustrative simulation of your choice.

**The task:**

- Study Section II of the attached paper by Jun Shibayama et al. It gives a set of update equations that realize an optimized version of the fully vectorial ADI-based BPM method.
- Implement the algorithm in a program. You should be able to make use of the program elements we have developed in the class. In particular, solution of a linear system of algebraic equations with a tri-diagonal left-hand-side matrix is the most complex operation involved. If this procedure is neatly packaged, the implementation of the method is not too difficult.
- Design the method such that it can be used for propagation along imaginary distance. We will show in the class that it can be used to obtain the fundamental mode of a waveguide.
- Choose a simple beam propagation problem to demonstrate that your solution works. This illustration should show the the vectorial nature of the propagating field. One option here is to obtain the fundamental mode of a simple rectangular-core waveguide.

**Notes:**

In real programs, the auxiliary code that takes care of the inputs, initialization, observation, etc. contains many more lines than the computational core. For this project, it is the core of the method that is important: It is therefore acceptable to write the rest of the code and the illustrative simulation as one-time example with hard-coded geometry and parameters.

**Potentially useful sources:**

Two papers are included in this package. The earlier provides a detailed description of vectorial ADI. The more recent one introduces a simplified version of the method — one that is faster and also easier to implement.