Metalens Design and Simulation with RSoft and CODE V

0. Abstract

An effective simulation approach for metalens design is demonstrated by combining multiple simulation algorithms. Finite-Difference Time-Domain (FDTD) or Rigorous Coupled Wave Analysis (RCWA) is used to calculate the phase delay of various individual nano-cells, and then efficient beam propagation methods are used to trace the beam through the metalens or its equivalent phase mask.

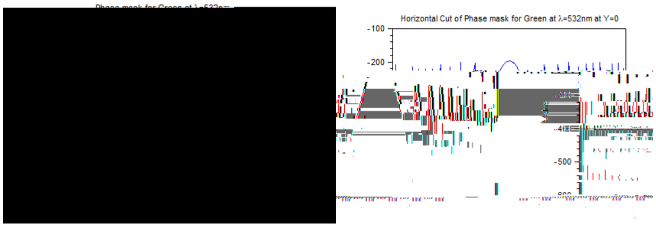

Figure 3: Phase mask of the metalens

2.3. Validation of BPM algorithm on a small structure

BPM is an efficient method to simulate forward propagation without accounting for backward reflections. We first validate BPM against the bidirectional FDTD algorithm on a small metalens 20µm in diameter and NA=0.25. The theoretical focal length is F=17.3µm. Shown in Figure 4 on the left is the BPM simulation result with F=16.96µm, and on the right is the FDTD result with F=17.14µm. This comparison shows that BPM agrees very well with FDTD for this application.

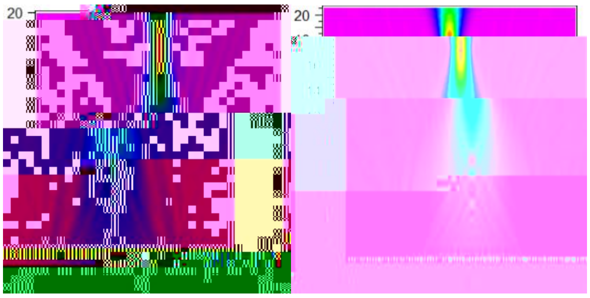

Figure 4: BPM result (left) and FDTD result (right)

For comparison the memory requirements for BPM were 0.19G and FDTD was 55G, and the respective simulation times