

Subwavelength Acoustic Sensing by Plasmomechanical Device

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Academic Disciplines:
Mechanical Engineering

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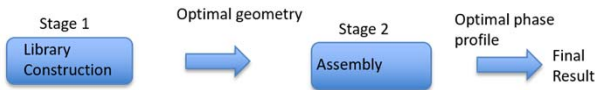
Problem Statement

- This work is aimed to realize high-throughput and high-tuning-rate subwavelength light localizations which have potentials in nanoscale acoustic sensing. In order to realize different subwavelength light localizations, optimization methods are used to optimize the geometry of plasmonic metamaterials and phase profiles of incident electromagnetic waves.

Research Methodology

- A two-stage optimization strategy is used to optimize the geometry of plasmonic metamaterials and phase profiles of incident electromagnetic waves

Two-stage optimization

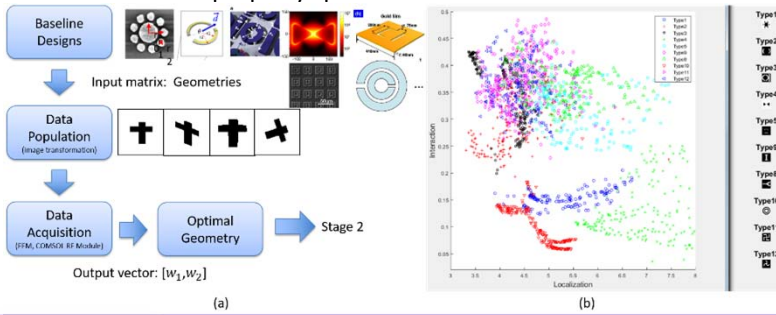


- Unit cell simulation
- Construct a **geometry library** with respect to a given frequency
- Identify an **optimal geometry**

- Array simulation
- Optimize **phase profiles** of incident EM waves to generate desired subwavelength light localizations

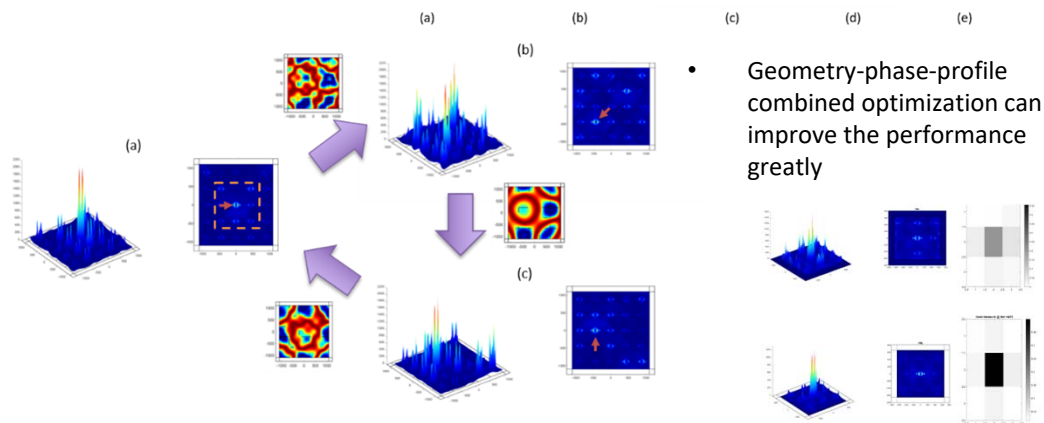
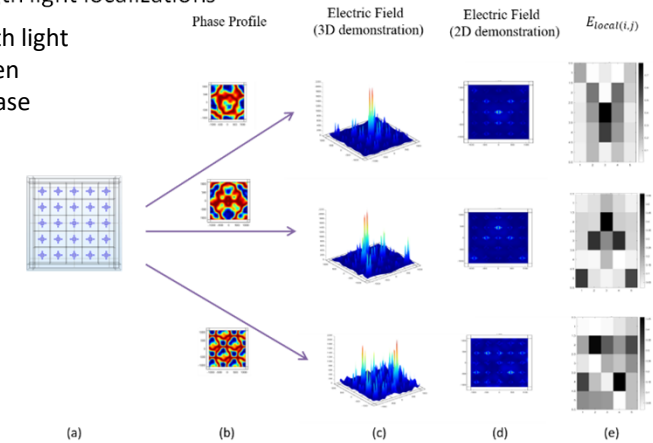
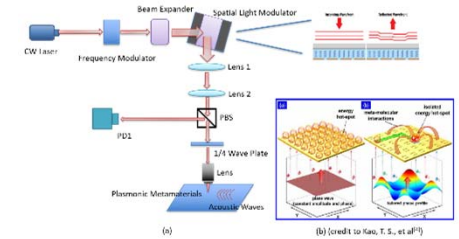
Stage 1: Library Construction

- In stage 1, a library containing over 2000 geometries of plasmonic metamaterials are characterized. The localization-interaction property space is obtained.



Stage 2: Assembly

- The best geometry is identified and used in the phase profile optimization to realize different subwavelength light localizations
- Three different subwavelength light localization patterns have been realized by optimizing the phase profiles
- By changing the phase profiles, the “hotspot” can be moved to different regions which makes fast-tuning subwavelength detection possible



- Geometry-phase-profile combined optimization can improve the performance greatly