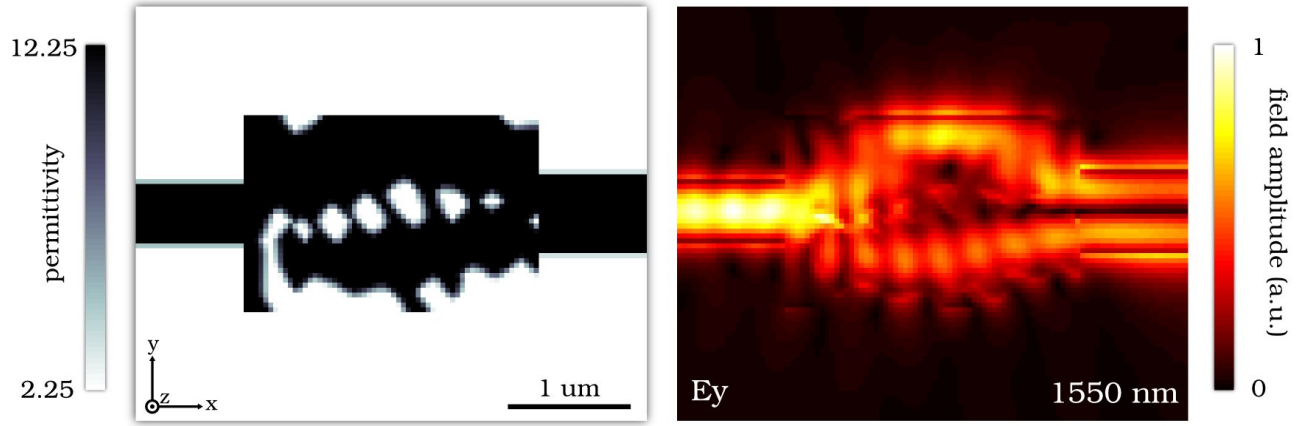
Nanophotonic Computational Design

Jesse Lu

February 25, 2013

Goal: Show you how to design *any* linear nanophotonic device



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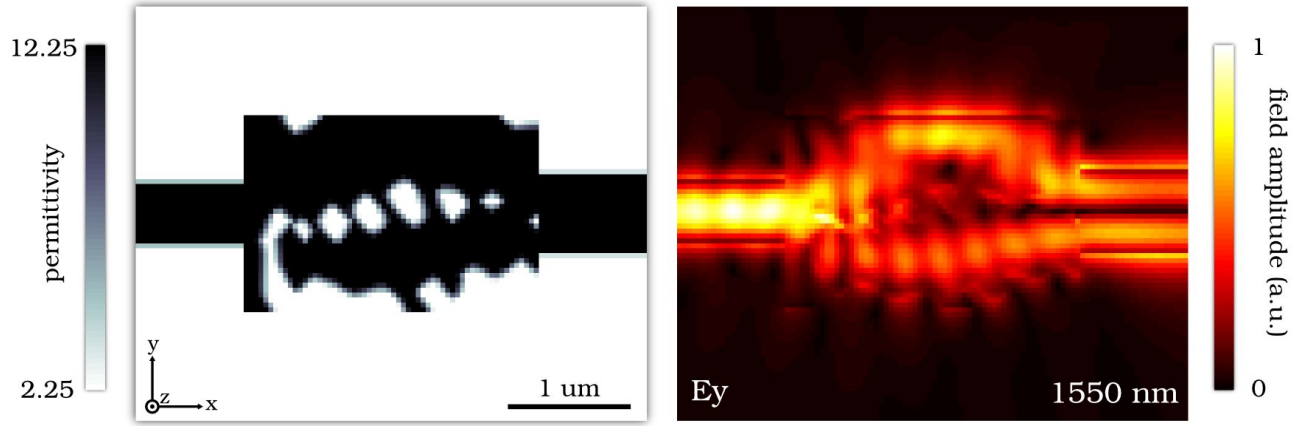

- Physics Advisory:

  CONTAINS INVOLVED MATHEMATICAL CONTENT

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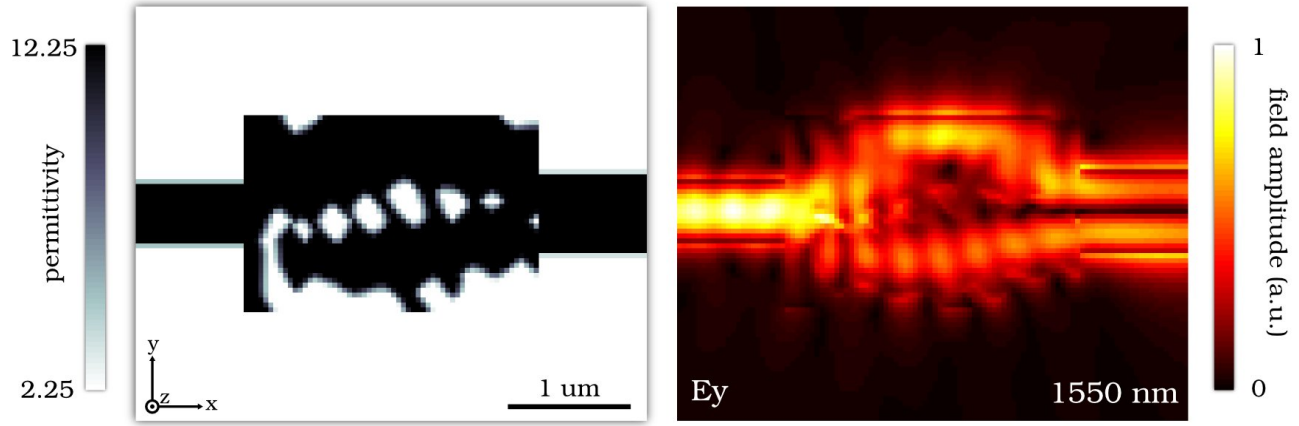

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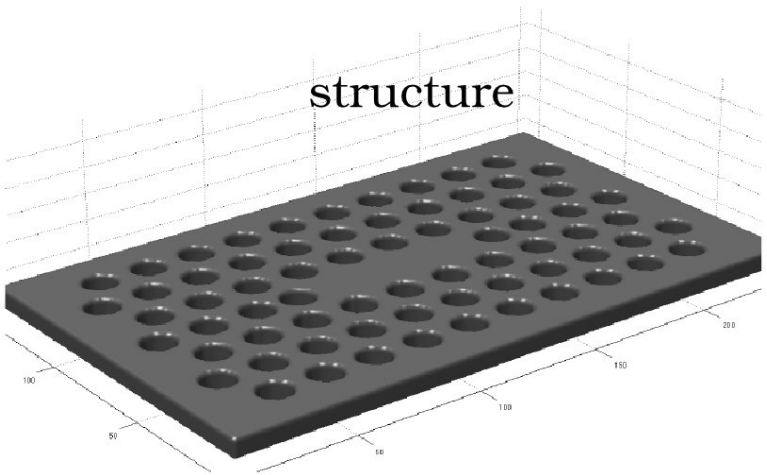
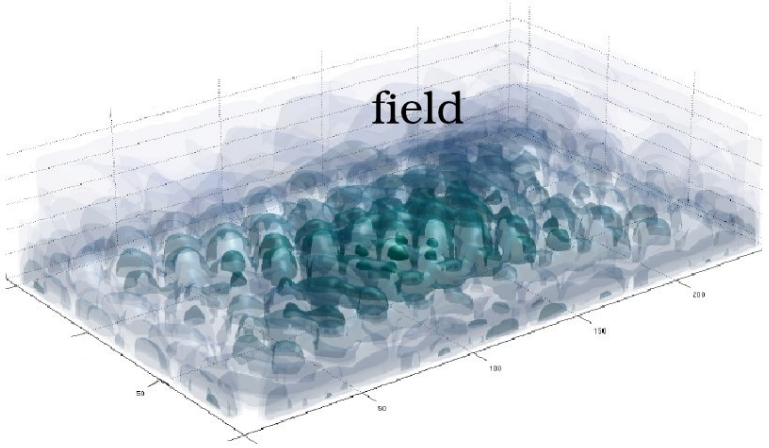
- Math Advisory:

  CONTAINS INVOLVED NANOPHOTONIC CONTENT

Given a field, can we find its structure?





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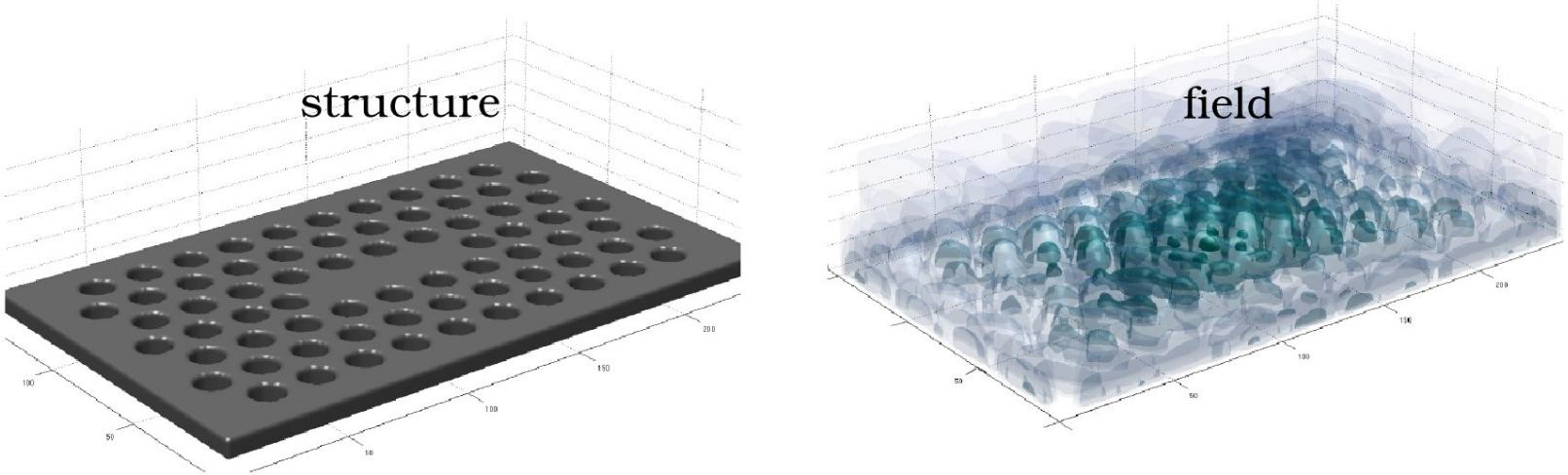

- Equivalently, find ϵ (structure) given E (field)

$$\nabla \times \mu_0^{-1} \nabla \times E - \omega^2 \epsilon E = -i\omega J$$

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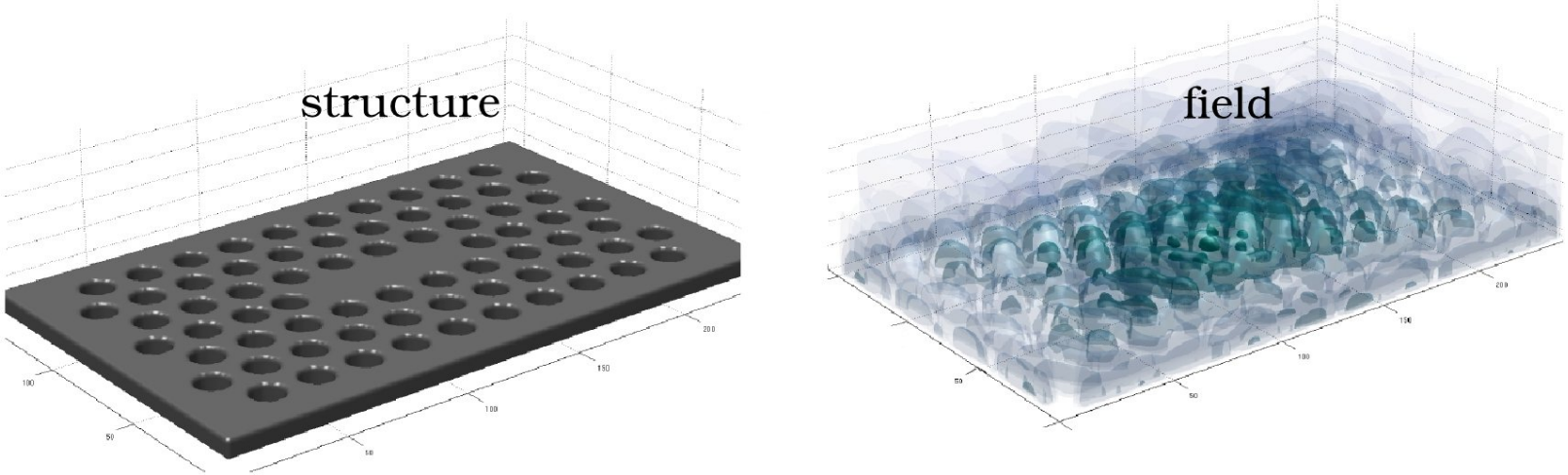

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- If possible, we can design *any* nanophotonic/optical component!

- Answer: Yes

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$$\omega^2 \epsilon E = \nabla \times \mu_0^{-1} \nabla \times E + i\omega J$$

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$$\epsilon = (\nabla \times \mu_0^{-1} \nabla \times E + i\omega J)/\omega^2 E$$