INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

OptoGPT: Foundation Model for Inverse Design of Optical Multilayer Thin Film Structures

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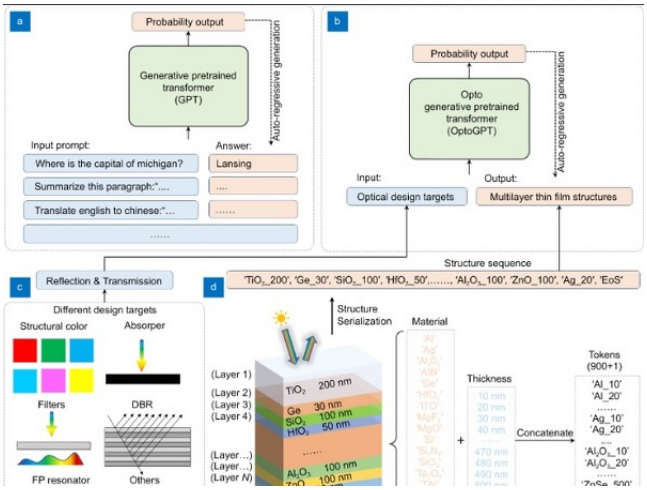

OVERVIEW

A foundation model for inverse design in optical thin-film structures

- Enhances design versatility and efficiency over traditional method
- Optical filters, absorbers, structural colors, Fabry–Pérot resonators

BACKGROUND

Optical multilayer thin-film structures are fundamental in photonics, used in applications like spectrum filters, absorbers, and structural colors. Historically, inverse design methods have relied on optimization algorithms such as Particle Swarm Optimization and Genetic Algorithms. While effective, these methods are often computationally intensive and may not easily adapt to complex design scenarios involving diverse materials and layer configurations. The need for an efficient and versatile design tool is evident, as existing methods struggle to incorporate material diversity and constraints effectively. Traditional approaches also seldom consider how to optimize designs for varying incident angles and polarizations, limiting their applicability in multifaceted optical environments. The development of a more versatile and efficient solution is thus essential to fully leverage the capabilities of optical multilayer thin films in advanced applications.

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Category

Hardware
Software
Engineering & Physical Sciences
Semiconductors, MEMS, and Electronics

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INNOVATION

Researchers at the University of Michigan have developed, OptoGPT, a foundation model inspired by generative pretrained transformers, that addresses the challenges of inverse design in optical multilayer thin-film structures. By introducing “structure serialization” and “spectrum embedding,” OptoGPT translates multilayer structures into a sequence for the model to process and match with target optical responses. This approach allows the model to autonomously determine the optimal material and thickness for each layer, considering a vast array of possible structures – up to 10^59 combinations. With its ability to handle diverse materials and constraints, OptoGPT can efficiently complete design tasks like creating absorbers and Fabry–Pérot resonators within seconds. Beyond speed, it offers high design diversity, essential for practical fabrication options. This innovation could transform optical thin-film applications by significantly enhancing the design potential and practicality for researchers and engineers, enabling more robust and adaptable solutions in the photonics field.

ADDITIONAL INFORMATION

REFERENCES

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