



Predictive Modeling of 1D Photonic Crystals for Nonlinear Optics

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Laboratory / Department / Team : Laboratoire ICB / Photonique / SAFIR

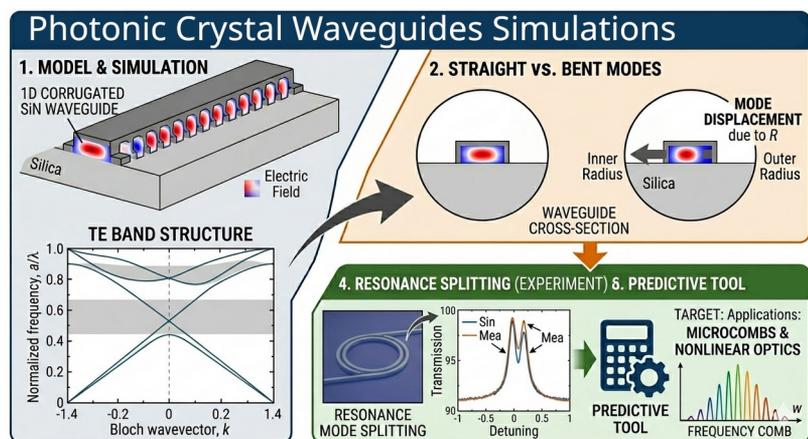
Collaborations:

Summary:

Photonic crystals (PhCs) are periodic optical structures that enable precise control over light propagation, forming the backbone of modern integrated photonics. In this project, you will design and simulate an infinite 1D corrugated waveguide, a practical realization of a PhC, using open-source electromagnetic solvers (MEEP/MPB or FEM). The goal is not just theoretical: you will compare your simulations against real-world measurements, bridging the gap between modeling and experiment.

Your work will culminate in a predictive tool for the eigenfrequencies of the PhC, accounting for critical effects like waveguide bending. This tool will have direct applications in nonlinear optics, particularly for optical frequency comb generation (microcombs), where precise dispersion engineering is essential. By the end of the project, you will understand how to design PhCs for targeted applications, validate your models experimentally, and contribute to a tool that could accelerate research in microcomb technology.

This project offers hands-on experience with industry-relevant simulation tools, a deeper understanding of photonic bandgap engineering, and the opportunity to develop a practical resource for ongoing research in nonlinear optics.



Type of project (theory/experiment): Theory/Simulation: 90% Experimental Data Analysis: 10%

Required skills:

- Basics of Electromagnetism/Optics: wave propagation, refractive index, periodic structures.
- Programming: Familiarity with Python (for scripting, data analysis, and visualization).
- Simulation Tools: Learn & use open-source EM solvers (MEEP/MPB or FEM tools).
- Data Analysis: Ability to interpret simulation results and compare them with experimental data.
- Technical Writing: Clear documentation of methods, results, and conclusions.