# Use of simulation results of integrated optoelectronic devices in an active learning approach

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This talk aims at showing the use of different simulation results (calculations, figures and videos) generated during the design phase of integrated optoelectronic devices in real industrial applications for active learning [1] activities. This content can be used in the physics and engineering classroom as: *1)* Examples to interpret certain concepts in Physics, *2)* To apply the theory learned to predict the performance of the devices, *3)* Compare the applied theory with the models use in industry and judge the disagreement in the predictions, *4)* Investigate and develop improvements in the device. Additionally, students can be motivated when connecting class theory with real state-of-the-art industrial applications [2].

The examples given are optoelectronic devices [3] which are used to create, manipulate and detect light. Regarding their proof-of-concept cycle, the different stages are: design, fabrication, and characterization. During the design stage, the physical structure is optimized to manipulate light in a certain way to achieve the desired outcome. A key method employed here is numerically solve Maxwell's equations in a 3D space. Most of the time, the computation effort is heavy but the accuracy is high.

A TE-pass polarizer [4] will be presented as an example to show the possibility of using *1-4)* to demonstrate the physics of gratings. The structure of the device is shown in Fig. 1(a) and it consist of a metallic grating in which the operational principle relies. Fig 1(b) and (c) were produced in the optimization phase of the device. They show the influence of the metallic grating on the propagation of light.

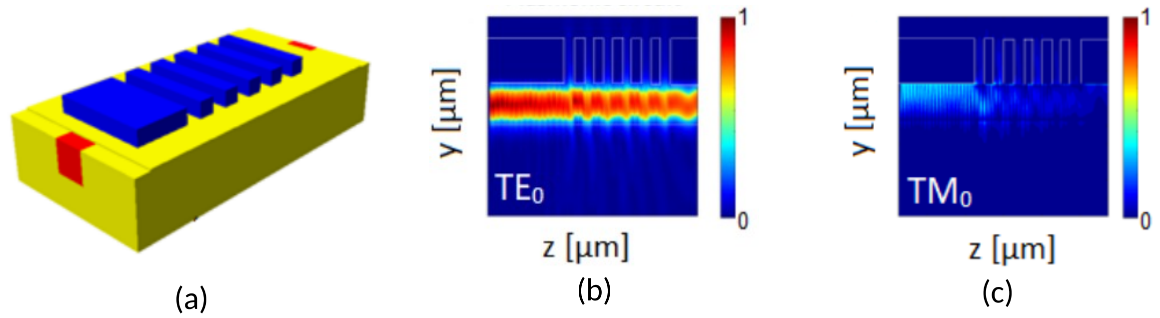


Fig. 1. (a) Structure of a TE-pass polarizer. Example of figure: (b) Normalized electric field magnitude of the propagating $TE_0$ mode, (c) Normalized electric field magnitude of the propagating $TM_0$ mode [4]

I proposed using the calculations and figures resulting from state-of-the-art simulations as the basis of active learning exercises in the last part of the lecture. Regarding the example presented here, the student will be guided to: *1)* Interpret the diffraction of light and its polarization dependence, *2)* Demonstrate the performance of the device *e.g.* operational wavelength and bandwidth by using the theory learned in class, *3)* Compare the theoretical model used in class with the one used in industry, *4)* Investigate and design possible improvements.

In this talk, I am going to cover the design aspects of several integrated optoelectronic devices used in optical communications and heat assisted magnetic recording [5]. I will show how the calculations, figures and videos produced in the design phase can be used in active learning to further engage with concepts and theories in physics and engineering [6].

**References:**

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