FHV

Design and Simulation in Photonics

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Wavelength division multiplexing (WDM) is the uncontested candidate for increasing the capacity throughput of optical networks. Optical multiplexers/demultiplexers based on arrayed waveguide gratings (AWGs) are the key components in such WDM systems because of their low insertion loss, high stability and low cost. To meet the growing capacity demands, it is necessary to continue increasing the channel count of these AWGs as far as possible. However, while the standard channel count (up to 16) and standard channel spacing (down to 100 GHz) AWGs feature very good transmission characteristics and are relatively easy to design, increasing the channel counts and narrowing the channel spacings present a serious challenge in designing AWGs.

When designing AWGs, the geometrical parameters of the structure have to be first calculated. These parameters create the input for AWG layout that will then be designed and simulated using commercial AWG tools like Optiwave, Apollo Photonics, R-soft, Photon Design or C2V, offered on the market (FHV owns two of these tools: Optiwave and Apollo Photonics). However, these commercial tools do not support or support only partially this fundamental calculation. Therefore, a new in-house software tool called "AWG-Parameters" was developed in the frame of student master thesis. This tool supports the calculation of the AWG geometrical parameters and this way strongly reduces the time needed for the AWG design.

The output of the Optiwave and Apollo Photonics simulations is an AWG spectral response for TE and TM polarization – the so called AWG transmission characteristics. They create the basis for the calculation of AWG transmission parameters like insertion loss, channel uniformity, adjacent- or not-adjacent channel crosstalk, etc. These parameters define the performance of an AWG and also determine its suitability for a particular application. However, this calculation is also not included in the commercial software tools. That makes the evaluation of the simulated or measured results rather difficult. To solve this problem another in-house software tool called "AWG-Analyzer" was developed in the frame of student master thesis. The tool also includes tutorial about AWGs, their functionality, fabrication, measurement and evaluation, and therefore can be used also in the education process.

Even some of the AWG design problems were already solved, another question is: Do the commercial photonics software tools offer the same or similar simulation results? To this purpose a project running between Research Centre for Microtechnology at Vorarlberg University of Applied Sciences and International Laser Centre in Bratislava (ILC) is devoted to this topic (ILC owns the R-Soft tool). In this presentation we will discuss all AWG design issues and also show some late results of the project. Since the fabrication process has a strong influence on the functionality of the final optical chip the comparison of the simulated and measured transmission characteristics will also be presented.

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