Ultra-compact reconfigurable photonic router

VNIVERSITAT DE VALÈNCIA

I+D RESULT

Patent

Knowledge area

- Communications
- Electronics
- Photonics

Collaboration

- Technology available to licensing
- Other collaborations may be considered

Ref. OTRI

201531R-Morais, M

Optical multimode interference coupler device and method for tuning the response of an optical signal

Inventors: Antonio Crespo Poveda, Maurício Morais de Lima, Andrés Cantarero Sáez (Universitat de València)

Background: Multi-Mode Interference (MMI) couplers are optical components widely used in the design of current photonic integrated circuits due to their robustness and small size. The operation of such couplers is based on the self-imaging properties of multi-mode waveguides. The transmission at each of the output ports of the MMI couplers can be modified by introducing additional phase differences in the multiple images formed at a given output plane. To do this, the MMI coupler is divided by said plane into two shorter couplers which are linked by an array of single-mode waveguides in which the phase differences are introduced. These phases can be introduced by various techniques, such as the inducement of temperature differences, or the application of electrical currents or high intensity optical beams. Due to the limited resolution of current lithographic techniques, a degradation of the response due to imperfections introduced during the device fabrication can be expected. From this viewpoint, it is desirable to remove these waveguides to achieve more robust devices. However, the implementation of the afore-mentioned modulation techniques in these devices presents great difficulties. It is therefore necessary to provide to the state of the art methods and devices to design and manufacture devices, considering the small size of the photonic integrated circuits.

The invention: Researchers at the Universitat de València have developed a novel ultra-compact reconfigurable photonic router consisting of an acoustically modulated MMI coupler driven by a single interdigital transducer -IDT-. By modulating inside the MMI coupler, the optical signal launched at a certain input waveguide oscillates between two of the output waveguides at the frequency of the surface acoustic wave. Because the invention is based on a single coupler MMI, it allows the design of very compact photonic modulators which are more tolerant to the manufacturing process.

Applications: The device can be used as building block in combination with other devices to constitute photonic circuits that perform more complex functionalities, such as modulation or routing, that are essential in nowadays optical communication.

Advantages: The main advantages provided by the invention are:

- Better manufacturing tolerances. Simplified operation of the device due to the use of a single surface acoustic wave generated by an IDT, so that the final product is "plug and play".
- The resulting devices are very efficient and quick, with operating frequencies in the range of a few GHz, and extremely simple due to the use of a single surface acoustic wave.
- The elimination of the waveguides of the modulated part of the device minimizes any imperfections that could be introduced in the manufacture. In this way, the performance of the device is improved, allowing also the design of more compact devices.

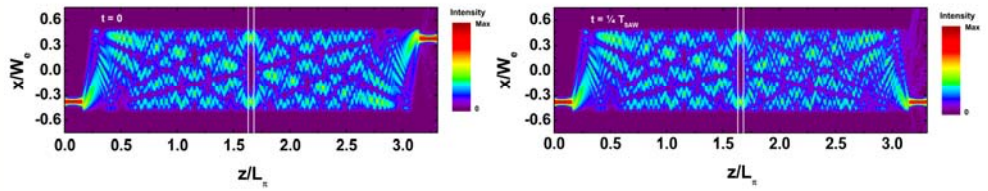

Figure 1: BPM simulations of one of the devices proposed with four guides of input and output for an acoustic phase shifts of 1.9 rad, calculated for two different times: t=0 (left panel) and $t=T_{SAW}/4$ (right panel), with T_{SAW} the acoustic oscillation period.

OTRI oficina de transferència de resultats d'investigació

Avda. Blasco Ibáñez, 13
46010 Valencia (España)
Tel. +34 96 3864044
otri@uv.es
www.uv.es/otri