

Evolution of Planar Waveguide Devices: Communication and Sensing Applications

Katsunari Okamoto
AiDi Corporation, Tsukuba, Ibaraki, 305-0032 Japan
katsu.okamoto@aidicorp.com

Abstract. *The talk will review progress and future prospects of two kinds of planar waveguide devices; they are (a) silicon photonics multi/demultiplexers for communications and (b) a novel spectrometer based on Fourier transform spectroscopy for sensing applications.*

Silicon photonics is widely regarded as a promising technology to meet the requirements of rapid bandwidth growth and energy-efficient on-chip communication while reducing cost per bit. Si photonics devices will have to deal with several tens of different wavelengths of light in the next-generation multi-core chips. There are mainly four kinds of devices capable of multi/demultiplexing tens of WDM signals; they are ring resonators, lattice-form filters, arrayed waveguide gratings (AWG) and planar concave gratings (PCG). The former two are cascaded devices relying on temporal multi-beam interference effect and the latter two utilize spatial multi-beam interference effect. Performance limitations in these filter devices due to the conventional SOI manufacturing processes will be described and a possible way of overcoming the problem will be discussed.

In the latter part of the talk, an integrated-optic spectrometer based on Fourier-transform spectroscopy will be described. A novel planar waveguide spectrometer consists of interleaved Mach-Zehnder interferometer (MZI) array. Practical importance of Fourier-transform spectrometer is the ability to correct for interferometer defects (phase errors) in data processing stage. Successful measurement results of the signal spectrum with 20-GHz resolution by the spectrometer implemented in silica-based planar waveguide will be presented. Miniature spectrometers will be important for daily health care and environmental sensing applications since they are compact in size (wearable) and potentially very low-cost (disposable).