Development of a Fully Integrated Chip-Scale Optical Fourier Transform Spectrometer with Channel Dispersion

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BACKGROUND

Optical spectroscopy excels at chemical identification and is ubiquitous in the sciences as a highly specific and noninvasive probe of molecular structure. The field is moving toward the integration of miniaturized optical spectrometers into mobile platforms which will have unprecedented impact on applications ranging from unmanned aerial vehicles (UAVs) to mobile phones. To address this demand, silicon photonics stands out as platform capable of delivering compact and cost-effective devices and systems. The Fourier transform spectrometer (FTS) is largely used in free-space spectroscopy, where its high signal throughput has proven a boon to overcoming the difficulties of otherwise overwhelming detector noise. Its implementation in silicon photonics manufacturing will contribute to bringing broadband operation and fine resolution to the chip scale enabling such attributes as compactness, power efficiency, real time operation and low cost.

TECHNOLOGY DESCRIPTION

Researchers at UC San Diego have developed an integrated chip-scale channel dispersed Fourier transform (CDFT) spectrometer that is fully CMOS compatible. This spectrometer enables mobile spectroscopy on the chip and the measurement of weak spectral signatures by implementing channel dispersion that significantly improves signal fidelity and measurement speed over comparable Fourier transform spectrometers. The micro-architecture minimizes size, weight, and power footprint (SWaP) of the spectrometer is entirely self-contained to implement analyte signal transduction, optical coupling, guiding, filtering, interferometry and signal readout to interface with an external microprocessor or computer. These improvements over existing models may be achieved by splitting the input signal spectrum into a number of bands, separately analyzing each of these bands using a Fourier transform spectrometer, and combining the outputs to generate a final spectrum.

APPLICATIONS

It can measure optical absorption, reflection, transmission, emission, scattering, and similar material interactions with light; it can be configured for operation in the visible, near infrared (NIR), or mid infrared (MIR). The reduction of the size, weight, power (SWaP) in this spectrometer and production costwill allow this technology to be widely deployed for a variety of other spectroscopy applications.

ADVANTAGES

This invention will improve the measurement speed, and relax the sampling rate and dynamic range requirements compared to conventional Fourier transform spectrometers. The microarchitecture minimizes size, weight, and power footprint (SWaP) of the spectrometer is entirely self-contained to implement analyte signal transduction, optical coupling,guiding, filtering, interferometry and signal readout to interface with an external microprocessor or computer.

STATE OF DEVELOPMENT

The project is currently at the conceptual stage of development.

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OTHER INFORMATION

KEYWORDS

Fourier transform (CDFT) spectrometer, CMOS compatible, micro-architecture, mobile spectroscopy on a chip, silicon photonics

CATEGORIZED AS

- **Sensors & Instrumentation**
  - Physical Measurement
- **Engineering**
  - Other

RELATED CASES

2018-138-0

INTELLECTUAL PROPERTY INFO

A provisional patent has been submitted and the technology is available to license.

PATENT STATUS

Country	Type	Number	Dated	Case
Patent Cooperation Treaty	Published Application	2019126786	06/27/2019	2018-138

Additional Patent Pending

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