Digital CMOS-compatible microring sensor for high precision detection

Technology #cu13325

Microring resonators have emerged as ideal candidates for high precision sensor devices due to their compact size and compatibility with standard CMOS microelectronic devices. However, current devices require bulky, expensive tunable lasers or monochromators and cumbersome approaches to achieve sensitive detection. This technology is a silicon microring resonator that utilizes an integrated heater to thermally tune its wavelength resonance. The technology provides a low-cost and compact means to sensitively detect, correct and digitally report perturbations to the system environment. As such, the technology provides a robust, high precision sensor useful for wide application in fields from biosensors to environmental monitors.

Simplified single wavelength laser source for a low cost, compact, highly sensitive sensor with digital output

This technology achieves the difficult task of wavelength resonance locking between the laser and microring resonator with a simple integrated heater. In the microring-laser system, the strongest optical transmission through the microring occurs on resonance with the laser source, thus perturbations to the microring resonance are detectable by observing changes to the transmission due to shifting resonances. To characterize perturbations, conventionally, the laser source is tuned, using expensive tunable lasers or monochromators, to match the shifting resonance of microring. This technology instead recalibrates the perturbed microring resonance using a thermal heater to again match it with the constant single wavelength laser source. The required heat control is recorded via a voltage feedback and thus a digital output is easily obtained.

A prototype of the technology has been tested and been shown to be highly sensitive, sensing even picometer shifts in wavelength resonance.

Lead Inventor:

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Applications:

- Sensors for temperature monitoring
- Sensors for environmental field studies from water supply to air pollution
- Biosensors for clinical diagnostics and drug delivery
- Cell-on-chip systems
- Biodefense sensors for counter-terrorism and public health
- Sensors for reconnaissance

Advantages:

- Compact device
- Utilizes cheaper single wavelength laser source
- Voltage readout of thermal control for easy digital output

Patent information:

Patent Pending

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Related Publications:


Inventors

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