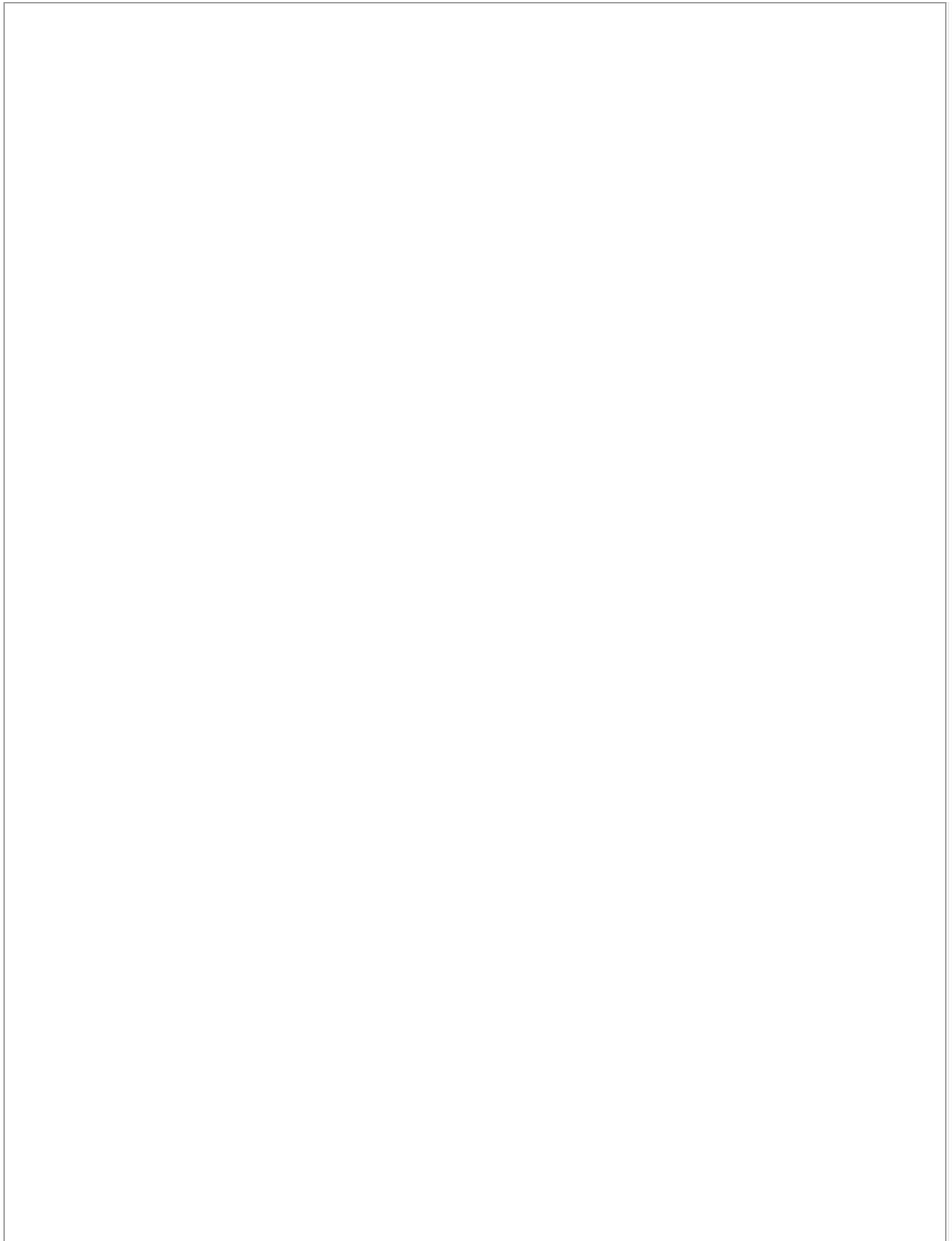


## Documents



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### **Integrating Vernier spectrum with Fano resonance for high sensitivity of an all-optical sensor**

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#### **Abstract**

Vernier and Fano resonances are promising approaches for enhancing the sensitivity of an all-optical sensor. A theoretical analysis was performed to integrate a Fano-like resonance shape with a Vernier resonance by considering the presence of partially reflective end facets at a double microring resonator waveguide. The system was developed based on scattering matrix and optical transfer function. The all-pass racetrack microring resonator (ARMRR) and the double racetrack microring resonator (DRMRR) were compared with and without the end facet at the waveguide to analyze the dynamic change of the output resonance spectrum. The spectrum was analyzed based on the free spectral range and resonance pattern. The resonator systems were applied to a refractive index-based sensing protocol, which was operated by a resonance wavelength shift with a refractive index change. The sensitivity was optimized by varying the configuration parameters such as the radius of the ring, the distance between the end facet, and the coupling coefficients. Integrating Vernier spectrum with Fano resonance improved the sensitivity for ARMRR configuration by 5.16% and the sensitivity for DRMRR configuration by 6.31%. The recorded limit of detection (LOD) of the DRMRR was  $3.30 \times 10^{-5}$ . © 2022, The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature.

#### **Author Keywords**

Coupling coefficient; Fano resonance; Microring; Sensitivity; Vernier effect

#### **Index Keywords**

Optical resonators, Optical transfer function, Refractive index, Resonance, Waveguides; All optical, All pass, Coupling coefficient, Fano resonances, High sensitivity, Microrings, Resonator configuration, Sensitivity, Spectra's, Vernier effect; Optical sensors

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