CURF
Clemson University Research Foundation

Increased High-Frequency Interferometer Sensitivity (2014-079)

Solves sensor sensitivity limitations via spectrum engineering and liquid-based tunable attenuator

Market Overview

These new methods involve a liquid-based continuously tunable attenuator and spectrum engineering techniques to significantly improve high-frequency interferometer sensitivity. Improved interferometer sensitivity would be advantageous for the wide chemical analytical systems market, which includes high performance liquid chromatography, gas chromatography, and biological sensors. There is a strong interest in minimizing the volume and concentration of sample materials while still maintaining sensitivity of the analytical systems. Unfortunately, current technologies are not able to give accurate readings with the reduced size desired. Clemson University researchers have developed several engineering techniques that, when combined with a continuously tunable attenuator, give unrivaled sensitivity that uses less material for analysis, thus improving cost-effectiveness.

Application

High Performance Liquid Chromatography; Medical Biosensors

Stage of Development

Prototype; proof-of-concept

Advantages

- Filters, resonators, and fast waves increase interaction times between RF fields and materials, increasing interferometer sensitivity
- Increases sensitivity of interferometer, resulting in less material needed for chemical analysis
- Utilizes known techniques without advanced electronics, reducing manufacturing costs

Technical Summary

This approach involves the operation of a highly sensitive, tunable and stable RF interferometer, which is based on quadrature-hybrids. The continuously tunable attenuator component uses liquids at different volumes to tune the operation of the interferometers for high sensitivity operations. The spectrum engineering techniques introduce filters, resonators, and fast waves that increase the interaction times between RF fields and materials. The interferometer has been tested to characterize and analyze DNA molecules in water solutions. The resonators and filters effectively demonstrate significantly improved RF interferometer sensitivities. The magnitude sensitivity improved by as much as 35 dB and the frequency sensitivity by as much as 10 times.

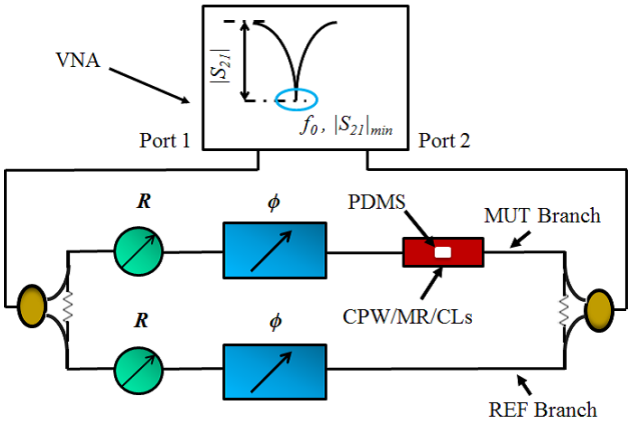

Figure 1: A schematic of the RF interferometer

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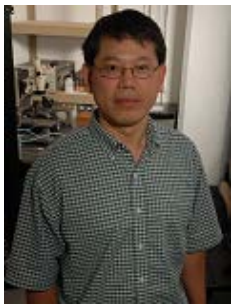
App Type	Country	Serial No.	Patent No.	CURF Ref. Number	Inventors
Provisional	United States	62/155,031	NA	2014-079	Pingshan Wang, Yongzhi Shao, Zhe Chen, Chao Shen

About the Inventor



Dr. Pingshan Wang is a Professor of Electrical and Computer Engineering at Clemson University. He earned his Ph.D. in Electrical Engineering from Cornell University. Before joining Clemson faculty, Dr. Wang was a Principal Engineer in charge of high-power microwave research at Applied Electronics, Mianyang, China. He also previously served on the faculty of Southern Illinois University Carbondale for two years. His research focuses on high-speed integrated circuits and systems, high-frequency microfluidics and nanofluidics, and high-frequency passive devices incorporated with ferromagnetic materials.

For More Information

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