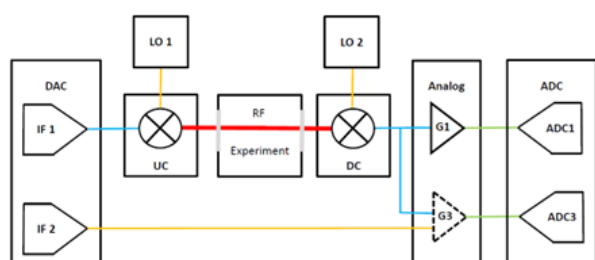


Vector spectrometer

Sensitive measurements for high-frequency signals

Invention

How can high sensitivities be achieved across a large spectral range? With high-resolution gigahertz and terahertz spectroscopy, for instance. This technology from the University of Cologne achieves these sensitivities with high-frequency signals from an arbitrary function generator



Schematic representation of the vector spectrometer

(shown here as a DAC), two mixers and local oscillators, a demodulator, and a fast analog-to-digital converter (ADC). They are connected as the figure shows. A local oscillator and the DAC, assisted by the mixer, generate an analog polychromatic excitation signal, which is coupled into the sensing device or measuring path where the sample molecules to be analyzed are located. After the RF signal has run through the measuring path once, a second mixer and a second local oscillator are used to mix it so that the two mixed sidebands lie one above the other and are offset as two frequency combs. Sample signal and reference signal are brought to cancellation for empty sample cells so that a signal arises only when the sample is present, greatly increasing the measurement method's sensitivity.

Commercial Opportunities

Application areas for this technology are in chemical analysis and quality control: Sensitivity in analysis sample measurement with high-frequency signals is greatly increased.

Current Status

The invention was reported to the German Patent and Trade Mark Office on 01/24/2022, and further subsequent foreign applications can be submitted in the priority year. The invention's functionality has been demonstrated in initial laboratory tests. A prototype is planned as part of further projects financed from third-party funds. On behalf of the University of Cologne, we are offering interested companies the opportunity to license this technology and cooperate with the inventors at the University of Cologne in its refinement.

Relevant Publications

Hermanns M., Wehres N., Lewen F., Müller H.S.P., Schlemmer S., Rotational spectroscopy of the two higher energy conformers of 2-cyanobutane, Journal of Molecular Spectroscopy 358 (2019), pp. 25-36

An invention of University of Cologne.

Competitive Advantages

- High sensitivity
- Large measuring and spectral range
- No frequency sweep necessary for many applications
- Simultaneous measurement of many monochromatic spectra

Technology Readiness Level

1 2 3 4 5 6 7 8 9

Experimental proof of concept

Industries

- Spectroscopy
- Chemistry and chemical analysis
- Pharmaceutical industry
- Quality control

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