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Abstract

Novel Algorithm for Calibration-Free Absorption Spectroscopy Sensor †

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Due to the enormous progress in availability and performance of laser light sources and electro-optical components, tunable laser diode absorption spectroscopy is currently more and more used for quantitative assessments of gas in several fields, such as medical breath analysis, atmospheric environmental monitoring, chemical analysis, industrial process control, and high-resolution molecular spectroscopy.

One of the most common limits to sensor performance is the presence of unwanted interference fringes arising, for example, from interfaces in the optical path. In this work, a novel algorithm is presented, which allows the extraction of a spectroscopic line from a background with arbitrary periodical disturbances without having any knowledge of their functional form or their time dependence.

A sensor using this algorithm, being insensitive to fringes and their change in time, will maintain its accuracy and will not need periodic calibrations. To demonstrate its performance and robustness, the algorithm is applied to simulated data and to oxygen absorption measurements. The results show that this method has the potential to further push the sensitivity of spectroscopic methods.

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