VRIJE UNIVERSITEIT BRUSSEL

The faculty of Engineering of the Vrije Universiteit Brussel invites you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES

of **Cedric Busschots**

The public defense will take place on **Wednesday 30th November 2022 at 5:00pm** in room **D.2.01** (Building D, Brussels Humanities, Sciences & Engineering Campus)

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EXPANDING AND IMPROVING THE LOW FREQUENCY FORCED OSCILLATION TECHNIQUE MEASUREMENT DEVICE

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Abstract of the PhD research

Respiratory diseases affect millions of people worldwide by lowering their quality of life. Nowadays, physicians heavily rely on spirometry as it is the leading measurement tool in diagnosis and follow-up of pulmonary conditions. Completing such a spirometry measurement is tiring due to the required forced expiration, especially for patients suffering from severe respiratory diseases. Therefore, spirometry can be unreliable in measuring treatment response and disease progression.

A different measurement technique has been in development for the last 50 years: the Forced Oscillation Technique (FOT). During such a FOT measurement, patients are usually allowed to breathe normally throughout the measurement. Instead of measuring the lung volumes and airflow during a forced expiration, a small pressure signal is added to their breathing signal and the response of the patient's lungs to this additional signal is registered. This small perturbation does not require patient unfriendly maneuvers.

In the past, interference prevented the use of additional pressure signals in the same frequency range as the breathing of the test person. Therefore, these setups focused on higher frequencies, missing out on the diagnostically interesting low frequency band.

Previous work studied a fan-based measurement device that solves this interference problem. This device allows to apply an excitation signal in the frequency band of the breathing. This measurement setup has been tested in a clinical environment at the university hospital, UZ Brussel in Jette. In this work, we have reprocessed the measurements of this feasibility testing.

The knowledge gained from these reprocessed measurements is then used to develop a new measurement device that covers both the low and high frequency range. By combining fans and speakers as actuators, both the low and high frequencies can be measured in a single measurement. This enables comparative measurements in both frequency ranges simultaneously.

Measurements with this new fan-speaker hybrid FOT device on two test persons show a significant improvement regarding patient effort and device performance.