UNIVERSITÄT ZU LÜBECK

TECHNISCHE HOCHSCHULE LÜBECK

Master's thesis

Topic:
Real time measurement of oxygen, argon and anaesthetic gas in an anaesthesia circuit

Summary:

The goal of this master's thesis is the integration of the gas sensor system in an anaesthesia circuit into a real time simulation with MATLAB Simulink. Furthermore, a previously developed approach for the compensation of argon and the determination of gas mixture fractions should be improved. To prepare the system for the use of O_2 90+, the density is used as additional physical property of the gas mixture. The density, in combination with the heat conductivity, enables the argon compensation and gas mixture fraction determination in an optimization algorithm.
A Simulink model was built for the currently used sensor system and calculates the intended gas concentration in real time. Due to the argon compensation approach, another model was generated that allows the calculation of the gas density. This is realised by using a bending quartz oscillator and its resonance frequency. The combination of the two real time Simulink models simulates the gas sensor system.
Previously identified weaknesses were enhanced by integrating new calculation approaches for the determination of the gas mixture fractions. The involvement of the gas viscosity is expected to have positive impacts as well. The accuracy of the gas mixture fraction determination was validated with the updated optimization algorithm. Therefore, complex binary, ternary and quadruple gas mixtures were given into the sensor system and an analysis was conducted. The cause of occurring deviations was identified and are the basis for new approaches to further improve the algorithm.
The results are promising, however, new challenges appeared within this work. They are stated in the outlook, together with possible amendments for the gas density sensor as well as the optimization algorithm.

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