

Master Thesis – IR-Optical Bench

Danfoss IXA A/S has developed a break-through infrared gas sensor technology for the simultaneous measurement of relevant parameters for climate and emission control such as temperature, humidity, CO₂, NO_x and other gasses in harsh environments or in other words as close to the source of emission as possible. Exact determination of these parameters to improve climate and process control enables significant energy savings and reduction of emissions.

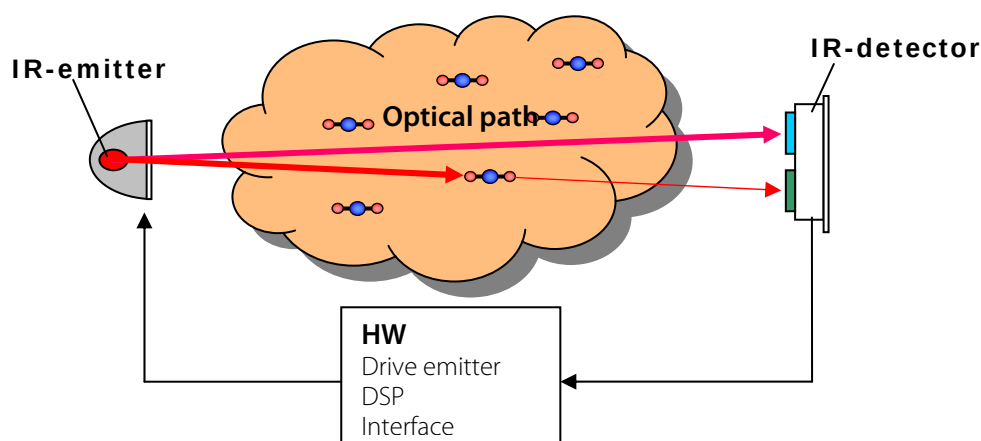
By combining highly sensitive sensor components with fast MEMS-based infrared sources and specific nano-structured protective surfaces, determination of these parameters is possible in environments where other systems fail due to e.g. contamination and corrosion. A second unique feature of the sensor system is the fast response time.

For further investigation and improvement of the sensor system it is required to realise a modular sensor setup – like an IR-optical bench – where it is possible to easily exchange components such as detectors and IR-emitters, change optical path lengths and geometry as well as add different windows, optical elements and change their position within the optical path.

There are very high requirements for accuracy and stability of the mechanical fixation of the components as well as for the reproducibility of the position and orientation of exchangeable components.

An electrical interface shall be established - besides of the mechanical interface - in order to drive the IR-emitter and monitor detector signals which are in the μV range. Existing electronics shall be used for that as much as possible.

Practical requirement for the setup is that it can interface with the measurement and calibration facility at Danfoss IXA in order to be able to characterise components under different ambient conditions and under different gas concentrations. A sketch of the general setup is given below.



The work shall cover the following tasks:

- Collecting requirements for the setup
- Concept
- Realisation of IR-optical bench
- Feasibility test
- Characterisation regarding stability and reproducibility of measurements

The student has to cover the following competences:

- Detailed Understanding of optics and measurement technologies
- Practical approach to mechanical constructions
- Basic education on HW and electrical engineering
- Team spirit and high level of self-motivation

Danfoss IXA A/S is an independent venture company focussing on unique sensor developments for Cleantech.

The unique, patented sensor technology is ideally suited to the global focus on energy and the environment. It is extremely robust and can precisely and continually measure climate parameters and environmentally harmful gases.

Danfoss IXA A/S is based in Vejle, Denmark, and has eleven employees. It is now positioned to take the next step in commercialising the technology, building up the company, and continuing to develop and market the technology globally.

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