Institut für Elektrische Messtechnik

Bachelor-/ Master Thesis

Impedance spectroscopy for characterization of multiphase mixtures in microchannels

Fluid flow in microchannels can be utilized for manifold applications, e.g.: Lab-On-A-Chip, micromixers, study of transport phenomena, etc. The required analysis of the fluid composition inside such channels can be done by electrical measurements e.g.: Impedance measurements utilizing electrodes, embedded inside the structure of the microchannel.
Therefore at our institute the following points provide the possible scope of a Bachelor-/ Master Thesis.

Tasks

- Review of impedance spectroscopy measurement technologies on liquids
- Preliminary tests with commercial equipment
- Development of a dedicated system for measuring the spectrum of liquid flows in microchannels at high repetition rates
- System performance testing and evaluation

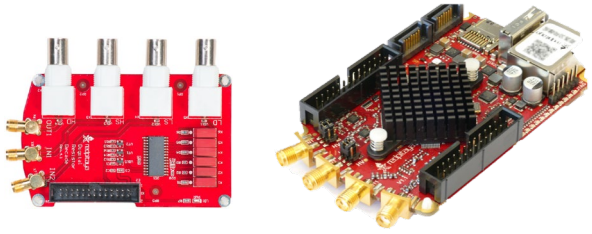

Figure: Commercially available impedance analyzer kit

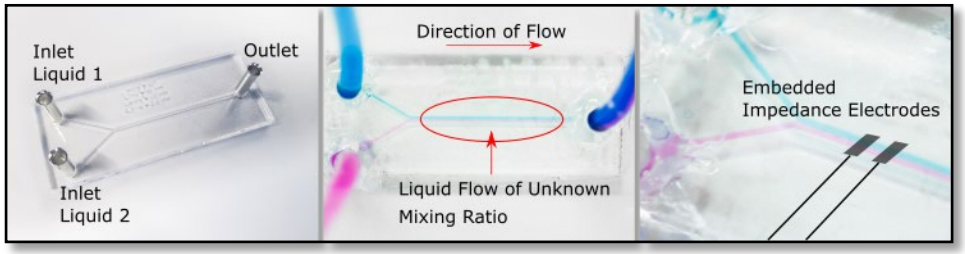

Figure: Y-shaped microchannel network with one inlet and one outlet milled in PMMA.

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Institut für Elektrische Messtechnik

Bachelor-/ Master Thesis

Development of an electronics for fast measurement of liquid conductivity

The fast (milliseconds repetition rate) measurement of liquid conductivity is required to monitor transient phenomena in some industrial applications. Current measurement systems can cover a broad range, but repetition rate is in the range of seconds.
Therefore at our institute the following points provide the possible scope of a Bachelor-/ Master Thesis.

Tasks

- Liquid conductivity from 10^{-4} to 10^{2} S/m is to be measured at repetition rate of kHz
- Contact and contact-free techniques are to be considered
- Test and definition of the most appropriate technique
- Implementation and system performance evaluation

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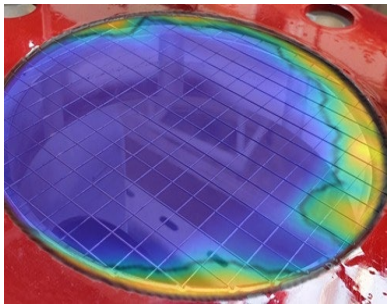
Bachelor-/ Master Thesis

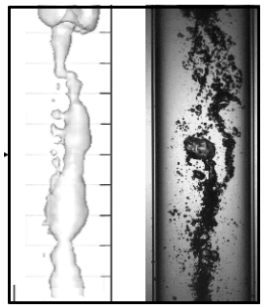
Flow rate measurement of multiphase mixtures based on tomographic sensor data

Currently there is a trend to apply tomography to investigate flow in pipes, where fast processes may occur (e.g. multiphase flow, chemical reactions in vessels). Flow rate measurement of multiphase mixtures is very challenging. Tomographic sensor data can be explored for this task. Therefore at our institute the following points provide the possible scope of a Bachelor-/ Master Thesis.

Tasks

- Review of measurement techniques for flow determination
- Study and implementation of two-dimensional cross-correlation Technique for tomographic data
- Development of data processing and parameter extraction algorithms
- System performance testing and evaluation based on synthetic and experimental data





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Institut für Elektrische Messtechnik

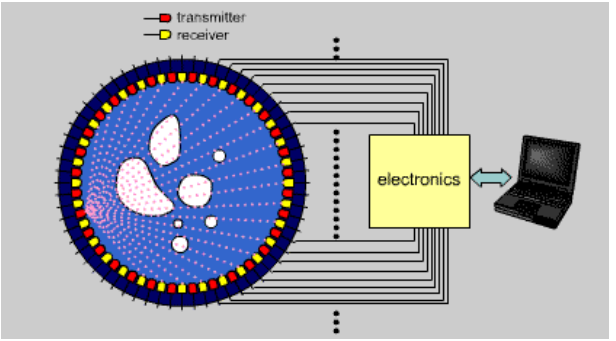
Bachelor-/ Master Thesis

Design and implementation of an optical tomography system for didactic purposes

Tomography is well known in the medical diagnostic. More and more tomography has been applied in non-destructive testing and process monitoring. This work aims to develop a optical tomography system for didactic purposes to be used in lab activities at our Institute. Following points provide the possible scope of a Bachelor-/ Master Thesis.

Tasks

- Review of review of tomography systems and tomographic image reconstruction
- Design of a tomography system based on LEDs and Photodetectors
- Implementation and tests of the tomography system
- Formulation of didactic lab activities



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Institut für Elektrische Messtechnik

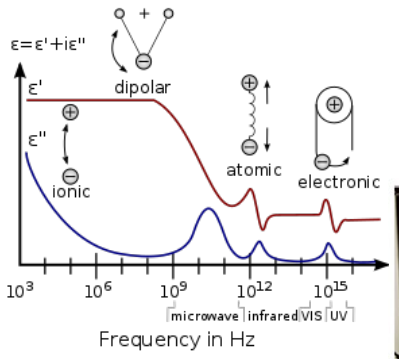
Bachelor-/ Master Thesis

Combined electrical and optical probe for the investigation of colloidal systems

Colloidal systems are commonly found in the chemical industry and consist of a continuous high volume phase (usually a liquid) and a dispersed phase (such as droplets, gas bubbles, or suspended solids). For a detailed characterization of such systems, the combination of dielectric and optical spectroscopy seems to be sought. However, as a new technology, such combined measurement systems require the design, development and testing of dedicated sensors and measurement circuits. The depth and scope of the work will be tailored as a BSc or MSc thesis.

Tasks

- Review of dielectric and optical spectroscopy of colloidal systems
- Design and implementation of dielectric spectroscopy probe
- Design and implementation of optical spectroscopy probe
- Combination of both systems in a single probe
- Testing for a chosen application such as crystallization, liquid-liquid extraction, multiphase flow.



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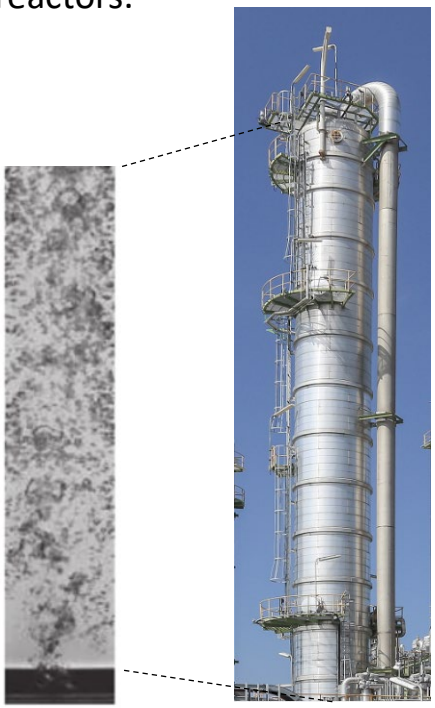
Bachelor-/ Master Thesis

Application of fiber-optic distributed sensor in a bubble column reactor

Bubble column reactors are very common in chemical processing industry. Nowadays only pressure and temperature measurements are commonly performed in such large installations, which in turn limits the possibility to optimally run processes. Here advanced instrumentation is urgently need, in order to cope with modern energy-saving process control. Distributed acoustic sensing (DAS) is a modern measurement technology which has not yet been tested in bubble columns and may be an good alternative to gather more information of chemical reactors.

Tasks

- Review of review fiber-optic distributed sensing
- Installation of a DAS system in a lab bubble column (in cooperation with Institute of Process Engineering)
- Performance of measurements and data analysis
- Modelling of the measurement chain and connection to reactor parameters
- (Master Thesis only) Possible suggestion of process optimization/control



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