TUHH

Institute of Process Imaging

Project thesis: Implementation of the Bayesian NMR algorithm to obtain bubble size distributions

Bubbly flows play an important role in many processes. While their effectiveness is known empirically, the understanding of the processes within a bubble reactor are still not understood fully. One important property is the bubble size distribution. There are many techniques to investigate such as electrical capacitance tomography (ECT) or optical imaging. While the first is limited by resolution, the second is limited severely by optical phenomena. Therefore, optical measurements can only be applied reliably at low air contents. A technique able to detect bubbles at higher gas content is magnetic resonance imaging (MRI). While it is important to measure bubble sizes directly from the images, this technique is limited in resolution both spatially and temporally. If the bubble size distribution is steady, a novel approach using Bayesian analysis developed by Holland et al.[1] can be employed. In this approach, the most probable bubble size distribution to fit a set of measurements is determined by statistical means. Since this approach is very relevant to many engineering applications, this project aims at the implementation of this approach.

Tasks for this project:

- Implement the Bayesian bubble size distribution algorithm in Python
- Evaluate the algorithm on simulated data
- Apply the algorithm on old data of solid-gas systems recorded in an MRI scanner
- (if time allows) Measure bubble size distributions and apply the algorithm

[1] Holland, D.J., Blake, A., Tayler, A.B., Sederman, A.J. and Gladden, L.F., 2012. Bubble size measurement using Bayesian magnetic resonance. Chemical engineering science, 84, pp.735-745.

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