31.07.2023

Project work / Bachelor thesis

Construction of a three-dimensional vibrated bubbling fluidized bed and investigation of bed hydrodynamics

Motivation:

Vibrated fluidized beds are extensively used in various applications of process engineering. However, due to the limitations of traditional measurement techniques, fluidization phenomena could not be completely understood. Innovative measurement and analysis techniques are needed to expand our understanding of fluidization phenomena and the impact of process conditions on fluidization behavior. For this purpose, real-time Magnetic Resonance Imaging (MRI) will be used to obtain high spatiotemporally resolved images of the complex gas-solid-hydrodynamics occurring in a vibrated three-dimensional bubbling fluidized bed.

The project is divided into two sections: The first part of the project aims at the construction of an MRI compatible fluidized bed and characterization of required particles for the experiments. The second part of the projects aims at the experimental investigation of fluidized bed hydrodynamics using MRI.

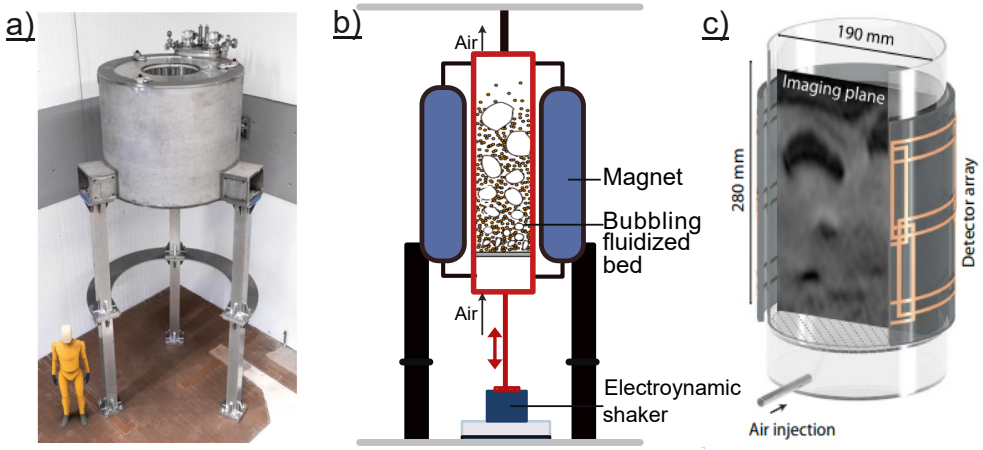

Figure 1: (a) Large bore vertical 3T magnet system at the Institute of Process Imaging, TUHH. Reactors up to 400 mm outer diameter and a height of several meters can be analyzed. (b) Proposed experimental setup.Vibration is transmitted from the electrodynamic shaker to the fluidized bed via a tube. (c) Real-time MRI of bubble characteristics in a three-dimensional fluidized bed [1].

Tasks:

- Construction of an MRI-compatible three-dimensional fluidized bed
- Determination of particle characteristics (NMR properties, particle size distribution, apparent density, etc.) and particle sieving
- Investigation of the impacts of vibration, particle type, and process conditions on fluidized bed hydrodynamics

Your profile:

- Ideally, basic knowledge of 3D sketching and data evaluation with python

Starting date: September 2023

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References: [1]Penn, A.; Tsuji, T.; Brunner, D. O.; Boyce, C. M.; Pruessmann, K. P.; Müller, C. R. Real-Time Probing of Granular Dynamics with Magnetic Resonance. Sci. Adv. 2017, 3 (9), e1701879. https://doi.org/10.1126/sciadv.1701879.