

Real-time Magnetic Resonance Imaging - From Granular Dynamics to Sustainable Process Engineering

Prof. Dr. Alexander Penn, Integrierte Biotechnologie und Prozesstechnik, Technische Universität Hamburg

Abstract: Magnetic Resonance Imaging (MRI) is an imaging technique mainly used in the medical domain that allows obtaining information about the structure and function of the human body non-invasively. In addition to showing us how MRI-active species (e.g. water molecules) are distributed in a sample, MRI can measure their velocity, diffusion constant, temperature, and even chemical binding state. In recent years, MRI has been introduced into the engineering domain where it is increasingly gaining traction. However, one major drawback of MRI compared to other tomographic techniques is the sequential nature of data acquisition, rendering MRI inherently slow. In recent years, a variety of scan acceleration techniques have been introduced to speed up MR data acquisition, such as array detection, single-shot readouts, and compressed sensing.

In this talk, I will show how MRI of dynamic granular systems has advanced from minutes to milliseconds temporal resolution within less than a decade and provide a perspective on where the journey of MRI in the field of Process Engineering might lead to.