

Video Based Validation Using Particle Tracing Methods for a Stirred Vessel

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Modelling a stirred tank is always a challenging task. In a stirred tank several processes (e.g. heat and component transfer, reaction) must be considered to build an adequate model. Nowadays Computational Fluid Dynamics (CFD) models can be used to model the different physical phenomena in a stirred tank. However the validation of these models is not an easy task. The basic validation methods use a transparent vessel, and ink, or electrochemical reagent, to provide mixing time values. Particle tracing methods can be good replacements because these are non-invasive in nature and provide reproducible measurements. The tracer particle can be followed in three dimensions to obtain particle trajectories.

In our work particle tracing methods were used to analyse the flow patterns in a laboratory glass reactor. The particle movements were recorded from two different angles to follow the trajectories of the particles in three dimensions in case of different mixer geometry. Besides the physical experiments, the geometry and the momentum balance model were implemented in CFD software. Then the CFD models were validated based on the experimental results. MATLAB/Simulink was applied for video processing, and COMSOL Multiphysics for CFD model implementation.

Keywords – Particle Tracing, Computational Fluid Dynamics, Video Processing, Stirred Vessel