SIMULATING TANK-MIXER PROBLEMS USING A TIME-VARYING MAPPED FIXED VALUE APPROACH

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With the goal of gaining insight into homogenization processes in the wine industry, common approaches of tank-mixer problems in CFD were evaluated. In light of the low viscosity of wine (between 1.66 and 3.28 mPas [1]), typical configurations include fast-moving propeller mixers (>1000 rpm) with large tanks (>10 m^3). The Moving Reference Frame (MRF) approach can be used for steady-state simulations, which is not appropriate when startup conditions or minimum mixing times are to be estimated [2]. The Sliding Mesh (SM) approach is computationally prohibitive in industrial scale simulations with fast-rotating propellers [3].

Our approach uses a steady-state MRF model to initialize the flow field in the tank. Subsequently, the same mesh is used to simulate a number of rotations using the SM approach to account for time-dependent behavior in the propeller zone. Multiple flow fields representing one rotation for the rotating zone surfaces are written out to be used with our reduced modeling approach (e.g. one flow field for every 5°). A new CFD case comprising only the reference frame mesh of the MRF simulation is set up with initial conditions of a non-moving liquid. The outer surfaces of the propeller zone are assigned values for the respective position of the propeller at each time point using the OpenFOAM® *timeVaryingMappedFixedValue* boundary condition. This method allows for the simulation of minimum mixing times with results similar to a classical SM approach, but with a gain of CPU time around 30.

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