Abstract Submitted
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Numerical Study of 3D Flow and Mixing Properties in the Rotated Arc Mixer[1] ESUBALEW ALEMAYEHU DEMISSIE, MICHEL SPEETJENS, HERMAN CLERCX, Eindhoven University of Technology, GUY METCALFE, Commonwealth Scientific and Industrial Research Organisation (CSIRO) — Laminar mixing of fluids is an important process in many industrial operations. However, insight into 3D flow and mixing in the devices remains limited. This is largely due to their complex construction, which makes experimental investigation difficult and representation by analytical solutions impossible. This motivates the current numerical study on essentially 3D flow and mixing properties in a device representative of a wide class of mixers: the Rotated Arc Mixer (RAM). Key aspects to be investigated are transient effects between consecutive mixing cells and role of fluid inertia. Two RAMs, comprising of 5 and 10 cells, have been investigated by resolving full 3D Navier-Stokes equations. Simulations exposed small backflow zones near to entrance (exit) of each cell. They also revealed that up to 40% of cell length is involved in flow transition. However, the extent of this transition depends on flow parameters and cell geometry. The flow retains global spatial periodicity of the mixer. Moreover, essentially 3D internal symmetries within each cell exist in Stokes limit. Poincaré sections show that the transient and inertia effects cause a change in the location and size of non-mixing zones. This implies a significant impact of these effects on the mixing properties.

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