Contribution ID: **47** Type: **Oral Presentation**

Fast simulation of a multiphase tundish flow by using recurrence CFD

Wednesday, 25 September 2024 09:20 (20 minutes)

Abstract

Simulating the inclusion removal process in a tundish requires the consideration of large range of time and length scales.**[1.]** Because of both the steel and argon inlet, small timesteps as well as a fine mesh are required due to turbulence. On the other hand, the cleaning process itself takes comparatively long times to reach a steady state and consequently large computational costs are required for a full simulation.

However, the recurrent nature of the turbulent flow allows to approximate its evolution in an efficient, physically sound way called recurrence CFD.**[2., 3.]** Starting from a short high-fidelity time series, further predictions are made based on iteration of the method of analogues, i.e. it is assumed that similar states evolve in a similar fashion. This also holds for the cell-to-cell transport behavior of the flow, **[4.]** which makes it possible to describe the dynamics of passive species without the need to solve the Navier-Stokes equations. Hence, computational costs are massively reduced and process-relevant durations may be simulated.

References

1. D.-Y. Sheng, Mathematical modelling of multiphase flow and inclusion behavior in a single-strand tundish, Metals 10 (9) (2020). doi:10.3390/met10091213
2. T. Lichtenegger, S. Pirker, Recurrence CFD - a novel approach to simulate multiphase flows with strongly separated time scales, Chem. Eng. Sci. 153 (2016) 394–410. doi:10.1016/j.ces.2016.07.036
3. T. Lichtenegger, S. Abbasi, S. Pirker, Transport in turbulent, recurrent flows: Time-extrapolation and statistical symmetrization, Chem. Eng. Sci. 259 (2022) 117795. doi:10.1016/j.ces.2022.117795
4. S. Pirker, T. Lichtenegger, Efficient time-extrapolation of single- and multiphase simulations by transport based recurrence CFD (rCFD), Chem. Eng. Sci. 188 (2018) 65–83. doi:10.1016/j.ces.2018.04.059

Speaker Country

Austria

Primary author: LUMETZBERGER, Hannes (JKU Linz / K1-MET GmbH)

Co-authors: PIRKER, Stefan (Johannes Kepler University); Dr LICHTENEGGER, Thomas (Johannes Kepler University)

Presenter: LUMETZBERGER, Hannes (JKU Linz / K1-MET GmbH)

Session Classification: Session 6

Track Classification: Modeling of Metallurgical Processes including Heat/Mass Flow Modeling of Liquid Metal and Solidification