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Characterization of polymeric mixing processes with non-conforming methods in OpenFOAM

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Polymer mixing processes are performed with the aid of devices characterized by complex geometries in which body-fitted simulations can hardly be performed. Non-conforming approaches, like diffuse interface, ficticious domain, immersed boundary or volume penalty methods, represent the best alternative to simulate these type of processes (single and twin screw extruders, banbury mixers etc.), that may also involve complex kinematics.

In this talk we present the results obtained with a simulation tool that has been developed based on the open-source CFD library OpenFOAM, for the analysis of industrial mixing processing of polymeric materials.

First, we compare accuracy, robustness and computational cost of different non-conforming discretization strategies, namely a diffuse interface penalization method [2] and a discrete-forcing direct-imposition immersed boundary method [1], and different solution strategies for non-Newtonian fluid flows with temperature dependent viscosity.

Then, we present the integration of a Lagrangian Particle Tracking analysis tool used to estimate the mixing index, a number that quantifies the mixing ability of the machine.

Numerical results for representative industrial geometries and processing conditions will be presented and discussed.

REFERENCES

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