Submission

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Title: Numerical simulation of the injection moulding filling stage using open-source and commercial software

Submission Type: Presentation

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Topic(s):
- Complex Materials
- Compressible Flows

Keywords: Injection Moulding process, Thermoplastics, OpenFOAM, Moldex3D, numerical modelling

Abstract: Injection moulding is one of the most important processing techniques for thermoplastic materials, and due to the high competition and product requirements, it demands continuous optimization. In industrial practice, aiming to minimize the resources spent on the design and manufacturing activities, it is common to resort to appropriate computational modelling tools.

However, mainly due to the typical high cost of proprietary software, the support of computational modelling tools in injection moulding design related tasks is not available to medium and small sized companies. This framework, and the clear perspective of the benefit brought by computational modelling, has been motivating the development of codes based on open-source libraries, has happens with OpenFOAM computational library. The numerical method is based on a compressible two-phase flow model, which is developed on a cell-centered unstructured finite volume discretization with a volume-of-fluid technique for interface capturing. This work aims to compare the numerical results obtained by an open-source solver with the ones obtained with the proprietary software Moldex3D, widely employed in industry. The case of study considered is the filling stage of the injection moulding process of a rectangular cavity and a tensile test specimen for a thermoplastic material modeled with an non-isothermal, inelastic and generalized Newtonian constitutive model. The Cross-WLF (Williams-Landel-Ferry) model is used to characterize the rheological behavior of the polymer melts, and the Tait equation is used as an equation of state, to relate the polymer melt density to pressure and temperature. The predicted melt flow front interface and fields (pressure, velocity and temperature) contours were found to be in good agreement with the commercial software prediction.

Comments:
