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Simulation of fluid flow in intermeshing co-rotating twin-screw extruders
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Introduction
Simulation of flow behaviour in twin screw extruders (TSE), has gained great endeavors in the past decades due to change of geometry with screw rotation and present of narrow gap region. Fictitious domain method (FDM) is used to avoid re-meshing. But the accuracy of FDM is not good enough particularly in the gap regions (Fig. 1) with high shear rates. For mixing analysis the accuracy of velocity field in the highly shear rate regions is essential.

Objective
Using non-conforming mesh refinement extended finite element method (XFEM) to capture discontinuity of field variables across the solid-fluid interface and high shear rate regions.

Methods
The non-conforming mesh refinement technique is based on one fixed reference mesh where the quality of the refined mesh preserved [1]. To ensure the continuity across non-conforming regions a Lagrangian multiplier as constraint is imposed (Fig. 2).

Results
Cross-section of twin screw extruder is selected as test case study geometry. We compared non-conforming FDM and XFEM results with boundary fitted mesh (Fig. 4).

In the gap region the XFEM shows much accurate result than FDM and it predicts the high value of velocity in y direction as same as BF result. We applied our method for 3D geometry of TSE (Fig. 5).

Conclusion
Introducing modified techniques based on the mortar element, FDM and XFEM to simulate the fluid flow inside 3D geometry of TSE with narrow gaps and compare these methods.

References: