Large-Deformation Fluid-Structure-Contact Interaction Analysis for Liquid Supported Stretch Blow Molding

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ABSTRACT

Liquid supported stretch blow molding is an advanced method to produce PET bottles integrating molding and filling process. Much trial and error, however, are required to decide parameters for the molding process. Thus, simulation of liquid supported stretch blow molding is indispensable.

Liquid supported stretch blow molding is regarded to be a fluid-structure-contact interaction (FSCI) phenomena among the injected liquid, workpieces and molds. An interaction between injected liquid and air should also be taken into account. Additionally, large deformation of workpieces and complex shape of molds should be considered. There have been no previous methods to solve such FSCI problems as far as the authors have known.

To tackle this problem, we have proposed a new coupling approach for the FSCI problems. In our method, the arbitrary Lagrangian-Eulerian (ALE) mesh is used to track the liquid-solid interface and the level set method is used to express the gas-liquid interface. In the present algorithm, level set is reinitialized and volume of liquid is corrected at each time step. Contact among structures is solved by the interior point method (IPM)[1]. For performing the parallel computing, our method has been implemented into FrontISTR[2], which is an open source parallel FEM software for large-scale nonlinear structural analysis.

A rotating oil tank problem[3], as an FSI verification example of the proposed algorithm, is solved and accuracy of deformation and mass conservation are successfully verified.

REFERENCES

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