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# Numerical simulation of the welding of thermoplastic parts using a level-set method

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## Abstract

The hydrogen tank liner constitutes the innermost layer of a hydrogen tank. The principal function of this polymer component is to restrict the diffusion of hydrogen particles. The aforementioned liners can be manufactured via extrusion blow molding, a manufacturing process comprising three distinct steps: extrusion, mold closure, and blowing.

This study seeks to employ numerical simulation of the mold closure step to gain deeper insight, adopting a macroscopic approach. The primary objective is to gain a comprehensive understanding of the welding that occurs during the mold closure, which is challenging to study experimentally.

This work employs a numerical approach, using a finite element method based on an anisotropic mesh, which has been refined through an immersed boundary approach based on a level-set method. This method allows for the combination of multiple physical approaches, thereby facilitating the identification of critical variables and the optimization of the quality of the conduction welding process.

The proposed model and numerical simulation approach will be presented and discussed with reference to several application examples. To verify the methodology, a two-dimensional model of the mold closure will be examined initially, with a multi-phase problem involving the polymer/air interface being simulated. Once validated, the simulation of the mold closure will be extended to a three-dimensional model.

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