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Development of Methods for Plastic Injection Mold Weight Reduction

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Abstract : Mold making techniques have focused on meeting the customers' functional and process requirements; however, today, molds are increasing in size and sophistication, and are difficult to manufacture, transport, and set up due to their size and mass. Presently, mold weight saving techniques focus on pockets to reduce the mass of the mold, but the overall size is still large, which introduces costs related to the stock material purchase, processing time for process planning, machining and validation, and excess waste materials. Reducing the overall size of the mold is desirable for many reasons, but the functional requirements, tool life, and durability cannot be compromised in the process. It is proposed to use Finite Element Analysis simulation tools to model the forces, and pressures to determine where the material can be removed. The potential results of this project will reduce manufacturing costs. In this study, a light weight structure is defined by an optimal distribution of material to carry external loads. The optimization objective of this research is to determine methods to provide the optimum layout for the mold structure. The topology optimization method is utilized to improve structural stiffness while decreasing the weight using the OptiStruct software. The optimized CAD model is compared with the primary geometry of the mold from the NX software. Results of optimization show an 8% weight reduction while the actual performance of the optimized structure, validated by physical testing, is similar to the original structure.

Keywords : finite element analysis, plastic injection molding, topology optimization, weight reduction
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