

# Design Optimization of Injection Molds with Conformal Cooling for Additive Manufacturing

Tong Wu, Suchana A. Jahan, Praveen Kumar, Andres Tovar, Hazim El- Mounayri,  
Yi Zhang, Jing Zhang, Doug Acheson and Razi Nalim  
*Indiana University-Purdue University Indianapolis, IN*

## **Abstract**

This is a framework for optimizing additive manufacturing of plastic injection molds. The proposed system consists of three modules, namely process and material modeling, multi-scale topology optimization, and experimental testing, calibration and validation. Advanced numerical simulation is implemented for a typical die with conformal cooling channels to predict cycle time, part quality and tooling life. A thermo-mechanical topology optimization algorithm is being developed to minimize the die weight and enhance its thermal performance. The technique is implemented for simple shapes for validation before it is applied to dies with conformal cooling in future work. A method for designing a die with porous material which can be produced in additive manufacturing is developed. Also a comprehensive set of systemic design rules are developed and to be integrated with CAD modeling to automate the process of obtaining viable plastic injection dies with conformal cooling channels. Finally, material modeling using simulation as well as design of experiments is underway for obtaining the material properties and their variations.