3D Printing of Parametrically Designed Microfluidic Molds

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Abstract

Microfluidic devices are typically fabricated using molds prepared via photolithography. Over the past few years, advances in the additive manufacturing industry have enabled the utilization of 3D printing for the rapid and cost-effective fabrication of microfluidic devices. Researchers often deal with design, fabrication, and microfluidic application development simultaneously, with a significant portion of time dedicated to designing microfluidic devices. Several computational tools have been reported for the automated design of microfluidic components. However, the design of complicated microfluidics circuits such as microfluidic large-scale integration for production via 3D printing is still a laborious and time-consuming task. Here, we report a parametric design approach for the fabrication of microfluidic molds using 3D printing. We developed a computer-aided design library of commonly utilized components to manipulate fluid in lab-on-a-chip devices. The programmability and modularity of the microfluidic components facilitate the user to readily design complex microfluidic devices using OpenSCAD and manufacture them using 3D printing. We demonstrate our approach's design capabilities by fabricating a diverse library of microfluidic molds using stereolithography and their performance analysis. We also show the fabrication of high-density biochips with individually addressable chambers that can be utilized for various downstream applications across different biomedical and biological sciences sectors.

Biography of Presenter

Muhammad Hassan Raza is a Ph.D. student in Nanoengineering at the Joint School of Nanoscience & Nanoengineering, North Carolina A&T State University. His research interests lie at the intersection of synthetic biology and microfabrication technologies. He is developing various techniques for storing digital information in DNA. He is also working on 3D printing of high-density microfluidic devices for applications in synthetic biology.