Is CAD Keeping Up?

Hod Lipson[1]

Many people refer to the advent of additive manufacturing as a manufacturing revolution. That's certainly true. But a bigger revolution is underway, one that is potentially more profound. We are changing the way we design, what we can design, and who can design. Additive manufacturing is ushering a revolution in design.

It is not surprising to see that some of the places that have become a focus of additive manufacturing buzz, like New York City, are not your traditional manufacturing hubs. They are centers of art and design, and it is often the artist and designers that are the real force behind the advancement of this technology—those who push the design envelope and venture deeper into the previously inaccessible design space.

Our manufacturing abilities today are not limitless, but they far exceed what we can design. We can 3D print today almost any shape we can imagine and describe to a CAD program; but our CAD software, and our imagination, are still limited. The gap between what we can make and what we can design is growing; design tools are not keeping pace.

Consider a natural hip joint: its optimal and custom contours and its porous internal structure that is precisely aligned with stress patterns. Such structures can be manufactured today relatively easily. Few but the most avant-garde software tools, however, can handle this level of design complexity; few designers can specify such designs and few analysis tools can simulate them accurately. Yet we will never take full advantage of additive manufacturing until our design tools catch up.

There is also a cultural barrier: For centuries, our design thinking has been shaped by our manufacturing tools. We still think in straight edges and sharp corners, because these were usually easier to produce. But not anymore. I often remind my students: If there is a straight edge or a sharp corner in your design, it's probably not optimal. Show me a straight edge or a right angle corner in nature.

Additive manufacturing technology is advancing in leaps and bounds, but this is just the beginning. As we move to printing in multiple materials, and printing in electronic materials, the design gap will widen. We hope to see more articles submitted from the design community, to help close this gap.

As the editor-in-chief, I hope that you enjoy this issue and join us as an active participant in this new Journal and resource. Look out for our next issue of the Journal publishing in early 2015.

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