COMPUTED AXIAL LITHOGRAPHY (CAL) FOR 3D ADDITIVE MANUFACTURING

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OTHER INFORMATION
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» Engineering
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BRIEF DESCRIPTION

Additive manufacturing fabrication methods are proliferating rapidly, with photopolymer-based approaches comprising some of the most prominent methods. These stereolithographic techniques provide a useful balance of resolution, build speed, process control, and capital cost (system metrics that typically must be traded off one against another). Resolving the speed limitations, surface roughness (stair-step artifacts), and requirements for support structures would provide the next major steps forward in the progress of these technologies.

To address this potential, researchers at UC Berkeley have developed a system and method that accomplishes volumetric fabrication by applying computed tomography techniques in reverse, fabricating structures by exposing a photopolymer resin volume from multiple angles, updating the light field at each angle. The necessary light fields are spatially and/or temporally multiplexed, such that their summed energy dose in a target resin volume crosslinks the resin into a user-defined geometry. These light-fields may be static or dynamic and may be generated by a spatial light modulator that controls either the phase or the amplitude of a light field (or both) to provide the necessary intensity distribution.

ADVANTAGES

UC Berkeley’s approach surpasses recently-reported volumetric aperiodic 3D structure fabrication using holographic light fields in its geometric flexibility. Similarly, the inherently volume-based approach of this technology provides an order-of-magnitude improvement in fabrication speed over conventional layer-by-layer “2 1/2D” printing techniques. Finally, the surface roughness problems imposed by layer-by-layer fabrication are substantially reduced if not removed entirely.

Past/current use has included improvement to photopolymer-based additive manufacturing

- Faster part generation
- Improved surface quality, no stair step artifacts from layering
- Reduction of geometric constraints that arise from 2D layer slicing, simplified post-processing

SUGGESTED USES

- Additive manufacturing generated optics with high quality surface finish
- Hollow or overhanging structures
- Large dynamic range mesoscale AM structures
- Printing/fabrication on a previously fabricated 3D structure immersed in the resin
- Processing very soft, flexible or brittle polymers and geometrically delicate/fragile structures (as there is no relative structure/fluid motion during printing).
RELATED MATERIALS

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

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▶ High Fidelity 3D Printing Through Computed Axial Lithography
▶ System And Method For Tomographic Fluorescence Imaging For Material Monitoring