

Assessing approaches to light modulation for volumetric additive manufacturing

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Computed axial lithography is a form of volumetric additive manufacturing centered around the tomographic reconstruction of a light dose from optimized projected patterns whose propagation direction is constantly moving relative to the printed material.

There are many ongoing efforts to expand the operating space of computed axial lithography, including one to scale down the minimum feature size from its current ~20-micron minimum to micron-level features in a ~cm-sized target volume, and another to scale up the accessible printing volume to more than a few centimeters while maintaining feature sizes in the 100-micron-or-less range. These efforts, while very different in their ultimate applications, share a common challenge: achieving the desired minimum feature size while maintaining well-defined projected patterns through the diameter of the printing volume.

Conventional projection optics are not well placed to accomplish this trade-off as the ratio of the printing volume's diameter to the minimum feature size grows. Therefore, the application of 'non-diffracting' beams and diffraction-aware computational optimization is an increasingly active direction in volumetric printing. In this talk I will discuss efforts to develop a comprehensive modeling framework for tackling these challenges.