Technical University of Denmark

Popular science summary of the PhD thesis

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Title of the PhD thesis	Tomographic Volumetric Additive Manufacturing Image-set optimisation and deformation mitigation
PhD school/Department	Department of Civil and Mechanical Engineering

Science summary

3D printing is usually imagined as a futuristic but slow, layer-by-layer process. Tomographic Volumetric Additive Manufacturing (TVAM) challenges that idea. It casts a sequence of light patterns into a rotating vial of liquid resin to solidify a full 3D object at once in seconds to minutes; a process visually akin to the Star Trek Replicator. In reality, the control behind TVAM stems from computed tomography, commonly used for imaging inside objects, such as at airport security.

Speed and simplicity, however, come with a catch: TVAM is extremely sensitive to how light travels through the resin and how the resin responds as it cures. This thesis considers sources of geometric inaccuracy across the printing procedure: from computing the light patterns, to the dose delivered in a real system, to the material's thermal and chemical response during and after curing. The work shows when modelling light intensity loss is worth the extra effort, clarifies how optimisation choices systematically change print quality, and separates the roles that variable temperature and variable volumetric shrinkage play in driving deformation. Finally, a new optimisation approach is proposed that prints a hollow, shell-like version of the part first and then solidifies the interior during post-curing with the aim of reducing thermal-related deformations.

Please email the summary to the PhD secretary at the department