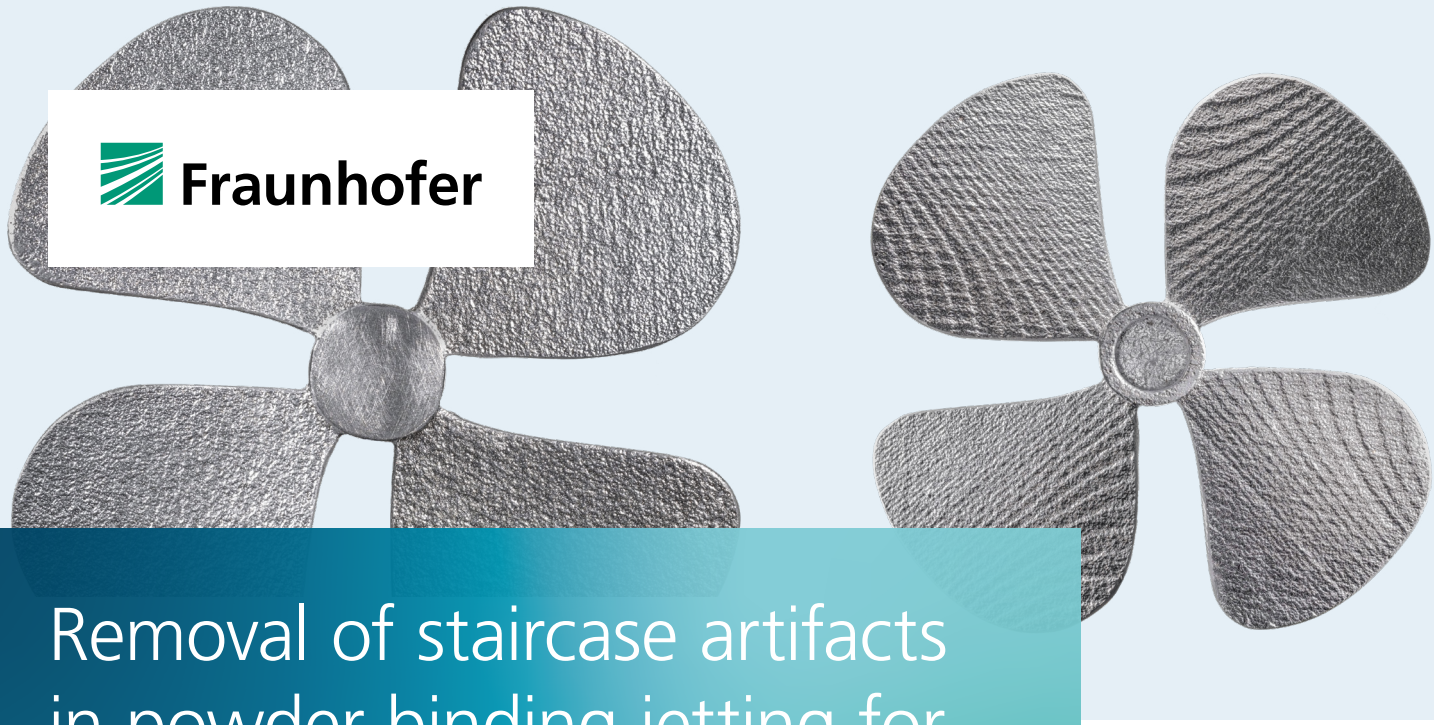


Removal of staircase artifacts in powder binding jetting for casting applications

Shape dithering removes voxel quantization artifacts, improving surface quality in 3D printing

Shape dithering is a parameter-free geometric method that removes voxel quantization artifacts in 3D printing.

Shape dithering is an efficient, purely geometric, algorithmic, and parameter-free method for improving surface quality and geometric accuracy in voxel-controlled 3D printing, including powder bed binder jetting. It mitigates quantization artifacts caused by discretizing continuous geometries into discrete voxels for printer control. These artifacts manifest as low-frequency geometric patterns on surfaces of arbitrary orientation, degrading visual quality and potentially adversely affecting the fatigue performance of printed parts.

Shape dithering redistributes geometric quantization errors across the surface, preventing their accumulation into distinct stair-step patterns. The resulting high-frequency surface variations are attenuated by the low-pass characteristics of the printing process, yielding a smooth surface with improved geometric fidelity.

The demo part is a fan blade cast in aluminum AlSi7Mg0.3 at a temperature of 720°C. The cast form is divided into two halves made with and without shape dithering (front and backside). As binder a commercial furan based no-bake system is used. A layer thickness of 300µm guarantees comparability to industrial use. The free-form surface area is left untreated after casting. The form is printed with a Konica-Minolta KM1024i without using its grayscale capabilities.

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exhibit overview