

# Volumetric Representations toward Additive Manufacturing

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## ABSTRACT

The needs of modern (additive) manufacturing technologies can be satisfied no longer by Boundary representations (B-reps), as they requires the representation and manipulation of interior fields as well. Further, while the need for a tight coupling between the design and analysis stages has been recognized as crucial almost since geometric modeling (GM) was conceived, contemporary GM systems only offer a loose link between the two, if at all.

For about half a century, (trimmed) Non Uniform Rational B-spline (NURBs) surfaces has been the B-rep of choice for virtually all the GM industry. Fundamentally, B-rep GM has evolved little during this period. In this talk, we will present a volumetric representation (V-rep) that is based on (trimmed) trivariate NURBs and can successfully confront the existing and anticipated design, analysis, and manufacturing foreseen challenges, toward porous, heterogeneous and anisotropic representation. We have extend all fundamental B-rep GM operations, such as primitive and surface constructors and Boolean operations, to trimmed trivariate V-reps. This enables the much needed tight link to (Isogeometric) analysis on one hand and the full support of additive manufacturing on the other.

In this talk, we will present the necessary tools to make this V-rep GM complete, and discuss two AM related applications that uses V-reps:

- Design and optimization of heterogeneous microstructures, toward 3D printing.
- Full 3-space (non planar) 3D printing via curve covering of V-reps.

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