

# Trimmed Tri-variate Spline Volumes for Design and Simulation in Additive Manufacturing

**Tor Dokken\* and Vibeke Skytt**

Department of Mathematics and Cybernetics  
SINTEF Digital  
PO Box 124 Blindern, 0314 Oslo, Norway  
e-mail: tor.dokken@sintef.no

## ABSTRACT

Additive Manufacturing (AM) is a true-born child of digitalization combining mathematics, material science, computational sciences, and process planning. Today, AM enjoys a boom. The potential impact of AM in coming years is enormous. However, the mathematical and computational communities have until now paid little attention to AM, and consequently AM technology and research have been addressed from the perspectives of manufacturing and material research. AM is fundamentally different from subtractive and formative manufacturing technologies where the material is supposed to be the same throughout an object, and only the outer shape must be described. In AM, material can vary inside an object, complex inner structures (e.g. lattices) can be manufactured, and anisotropic material behaviour should be taken into consideration already during design.

State-of-the-art CAD/CAE is based on ideas that originated in the 1980s and were designed to support subtractive and formative production. Today, they represent a bottleneck in the adoption of AM. The tri-variate spline representation of shape used in Isogeometric Analysis (IGA) are well suited to address challenges of AM such as tri-variate shape representation, and analysis-based design.

The talk will address the ideas, progress and results of the CAxMan project: *Computer Aided Technologies of Additive Manufacturing* [1]. We will especially focus on the use of trimmed spline volumes in IGA. CAxMan has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 680448, and is a Research and Innovation Action under the Factories of the Future Workprogram.

## REFERENCES

[1] <http://www.caxman.eu>