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Optimization of Extrusion Dies Comprised of CAD-Compliant Microstructures

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Through recent advances in modern production techniques, particularly in the field of additive manufacturing, new previously unthinkable geometries have become feasible. This vast realm of new possibilities quickly surpasses an engineer's design intuition and can only be adequately addressed by means of numerical optimization. To this end, this work aims to present concepts that exploit the emerging possibilities, specifically in the context of plastic extrusion.

The proposed concept is based on a microstructured grid, where the geometry is constructed through means of composition between two splines, a macro-spline that determines the outer geometry and a micro-spline, defining the geometry of individual building blocks. This approach opens up a broad design space, since both geometric components can be modified individually. The geometric representation employs volume splines, providing full compatibility with CAD/CAM [1].

The presented framework is used to create a passive heat regulation through targeted manipulation of the geometry and material parameters. In particular, we address the heat transfer in extrusion dies, where the viscosity of the melt – and as such the material flow – can be influenced by adjusting the temperature distribution. Combining the above methods, the geometry is optimized to compensate for irregular boundary conditions.

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REFERENCES

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