

September 7, 2021

Dear Editor-in-Chief, and dear reviewers,

We are pleased to submit our manuscript entitled “ITIM: Interlaced Topologically Interlocking Microstructure for continuous dual-material extrusion” for consideration for publication in the journal Additive Manufacturing.

When printing dual-material products using Fused Deposition Modeling (FDM) the adhesion between incompatible materials can be increased significantly using dovetail type interlocking geometry at their boundary. However, dovetail type interlocking designs can often be disassembled vertically, introduce extrusion discontinuities, and rely on the rigidity of the interlocking structure, which is difficult to model. We therefore introduce a novel type: topological interlocking, which addresses these concerns. We propose analytical models for two variants of our Interlaced Topologically Interlocking Microstructure (ITIM) with which their dimensions can be optimized and show that they agree reasonably well with simulation results and experimental test data. Which of the two variants outperforms the other depends on the space in the product available for the interlocking structure.

We believe this research is highly relevant to the journal, since it proposes novel methods to expand the multi-material capabilities of FDM systems. It is particularly relevant since additive manufacturing is the only available product technique for topologically interlocking structures, since such structures cannot be assembled or disassembled without breaking them.

This manuscript describes original work and has not been published and is not under consideration for publication elsewhere. All authors approved the manuscript and its submission. We have no conflicts of interest to disclose.

Thank you for your consideration and we are looking forward to your response.

Sincerely,

Tim Kuipers, Software engineer at Ultimaker
Renbo Su, PhD candidate at The University of Manchester
Jun Wu, Assistant professor at Delft University of Technology
Charlie C. L. Wang, Professor at The University of Manchester

