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COMBINED LENGTH SCALE AND OVERHANG ANGLE CONTROL IN MINIMUM COMPLIANCE TOPOLOGY OPTIMIZATION FOR ADDITIVE MANUFACTURING.

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Abstract: This contribution focusses on topology optimization for additive manufacturing. In order to ensure that the optimized design is immediately manufacturable, it is essential to take into account the appropriate geometric constraints during the optimization. Two important constraints are minimum length scale and maximum overhang angle. A minimum length scale is needed to ensure that the condition on minimal printable feature sizes is satisfied, while an imposed overhang angle eliminates the need for a temporary support structure. This contribution first shows that both constraints cannot simultaneously be met by a straightforward coupling of existing methods for length scale and overhang control. Next, a new filtering scheme is introduced, based on a specific combination of spatial filters, which allows direct control over these constraints in a minimum compliance topology optimization problem. A 2D benchmark problem and a complex 3D case study are presented to demonstrate that the proposed filtering scheme successfully imposes a target length scale in both the solid and the void phase of the design domain, while simultaneously allowing control over the overhang angle.