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OPTIMIZATION OF SUPPORTS FOR ADDITIVE MANUFACTURING

Grégoire Allaire[1], **Beniamin Bogosel**[2]

[1] CNRS, Centre de Mathématiques Appliquées, École Polytechnique, Palaiseau, France,
gregoire.allaire@polytechnique.fr,
http://www.cmap.polytechnique.fr/~allaire/

[2] CNRS, Centre de Mathématiques Appliquées, École Polytechnique, Palaiseau, France,
beniamin.bogosel@cmap.polytechnique.fr,
http://www.cmap.polytechnique.fr/~beniamin.bogosel/

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Support structures are essential for ensuring the quality of printed pieces with SLM (selective laser melting) technologies in additive manufacturing. Since support structures consume both impression time and powder material it is desirable to limit the supporting structures to a minimum, while maintaining their desired properties. We present below how to integrate some of the desired characteristics of supports into mathematical models which can allow us to optimize their shape, while decreasing their volume.

In a first part we present how to find and optimize the position of the supports by using linearized elasticity systems in order to maximize the rigidity of the whole structure part/support. We also show how one could optimize the support in order to evacuate the heat resulting from the fabrication process. Finally, we show how one could incorporate in the model other relevant facts in industrial applications, like the necessity of supporting all surfaces which are almost horizontal and penalizing the contact surface between the piece and its support.

For all models described we provide numerical simulations based on the level-set method for parametrizing the shapes and using shape derivatives in order to apply efficient optimization algorithms. The implementation is done with the aid of the freeware software FreeFem++ [2] and additional libraries MshDist and Advect for dealing with optimization problems related to the level-set method.

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