OPTIMAL CONTROL OF VOLUME-PRESERVING MEAN CURVATURE FLOW

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ABSTRACT

We present the framework and numerical method developed in [1] for controlling the full space-time tube of a geometrically driven flow. We consider an optimal control problem for the mean curvature flow of a curve or surface with a volume constraint, where the control parameter acts as a forcing term in the motion law. The control of the trajectory of the flow is achieved by minimizing an appropriate tracking-type cost functional. The gradient of the cost functional is obtained via a formal sensitivity analysis of the space-time tube generated by the mean curvature flow. We show that the perturbation of the tube may be described by a transverse field satisfying a parabolic equation on the tube. We propose a numerical algorithm to approximate the optimal control and show several results in two and three dimensions demonstrating the efficiency of the approach.

References

[1] A. Laurain, S. W. Walker *Optimal control of volume-preserving mean curvature flow*, J. Comput. Phys. 438 (2021), 110373.

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