

Equivalence extensions for problems defined on surfaces

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Partial differential equations on surfaces have wide applications in many areas, such as material science, surfactant problems, image processing and biology. These PDEs usually originate from minimizing energy functions defined on surfaces. In this talk, we present equivalence extensions for problems defined on surfaces. We target applications that use implicit or non-parametric representations of closed surfaces or curves and require numerical solutions for minimization problems defined on the surfaces.

We develop a framework that solves problems defined on surfaces using Cartesian grids on nearby narrowband regions of the surfaces. The methods can be applied successfully to elliptic and hyperbolic PDEs, mean curvature flow, and optimal transport problems defined on surfaces. Moreover, the extended problems share the same solutions as the original problem in the sense of restriction. Some numerical examples demonstrate the accuracy and efficiency of the proposed method.