Optimization-Based Conservative Remap
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Theorem (FCR ⇒ OBR). Flux-corrected remap (FCR) can be formulated as a (global) constrained optimization problem.

(1) The objective function of this optimization problem is equivalent to the objective function used in the OBR formulation.

(2) The feasible set of this optimization problem is always a subset of the feasible set of the OBR formulation.

Admits a larger feasible set!

Comparison with Flux-Corrected Remap, Part I

Smooth mesh motion

Comparison with Flux-Corrected Remap, Part II

Cylindrical Mesh Compression

Error in 'Sine', \( K = 1024 \)

Computational Feasibility (1D Results)

The optimization problem can be reformulated as a box-constrained QP with a single equality constraint.

Solved using a penalty formulation and a finely tuned Newton-type method based on Coleman/Hulten (1993).

Redundant (fixed) variables are recognized and eliminated automatically — physics-aware computation.

Fast linear algebra enables \( O(K) \) complexity.

References