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Convergence of Discrete Exterior Calculus

Discrete exterior calculus (DEC) is a structure-preserving discretization of exterior calculus put forward by N. Hirani and his collaborators. By using simplicial complexes from algebraic geometry and the connection between a triangulation and its dual, DEC preserves key geometric structures of differential forms that are important for computation. Applications of DEC include problems from homology, Riemannian geometry, fluid dynamics and discrete mechanics, such as variational problems in computer vision and animation. However, establishing a convergence theory for DEC remains an open problem. We will share recent advancements for boundary value problems on 0-forms and discuss the main difficulties in extending these results to higher-order forms and approximations.