Introduction to Student Projects

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Towards web modeling of geometric data

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- Going towards the availability of simple, general-purpose, dimension-independent geometric data structures and computational methods

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- post-processors towards graphics renderers and user interfaces

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- to simulate and predict behavior and performance

Towards novel solid and physical modeling

Conventional geometric modeling

Conventional geometric modeling is rather limited in scope,

being typically restricted to certain classes of triangulations or tensor-product domains in 2D or 3D, and most often confined to boundary representations.

Contrariwise, we need out-of-the-box computational representations and methods that support geometrical and physical computations on meshes of any sort.

Modeling inside boundaries: cellular complexes

All meshes—partitioning either the boundary or the interior of the model domain—and all physical quantities associated with them, may be properly represented by chain/cochain complexes.

A chain complex is a sequence of linear spaces of d-chains, $0 \leq d \leq n$, together with a sequence of linear boundary operators ∂, each mapping the space of d-chains into the space of $(d-1)$-chains.

Cochain complexes are dual to chain complexes; the coboundary operators δ, mapping the spaces of d-cochains into the spaces of $(d+1)$-cochains are dual to the boundary operators *partial*.