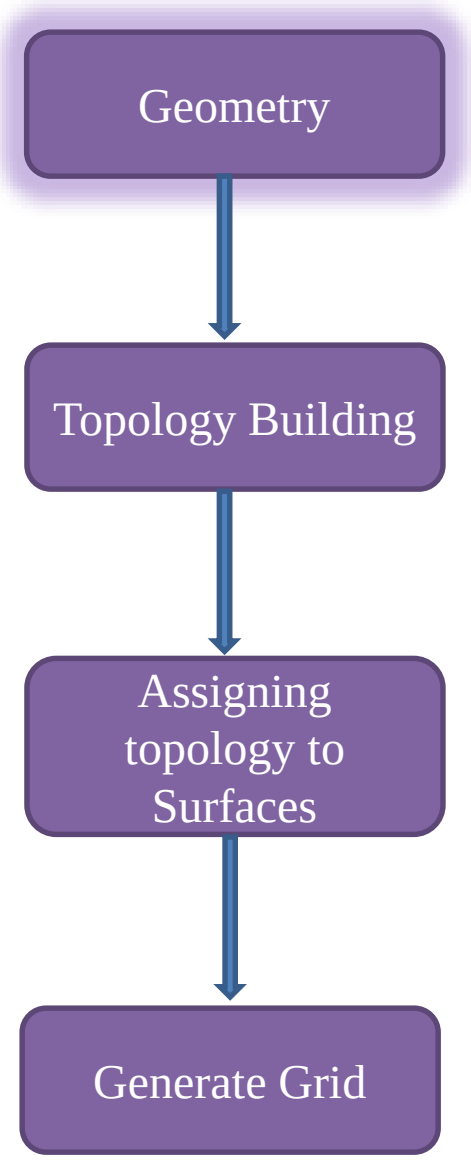
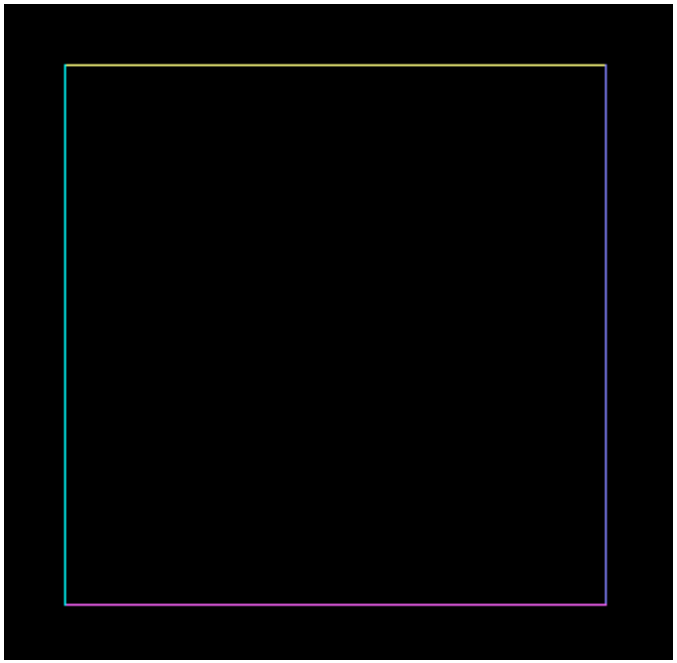
Basic GridPro Methodology





Step 1: Import or Create the geometry

Load surfaces that leaklessly bound the region to be gridded.

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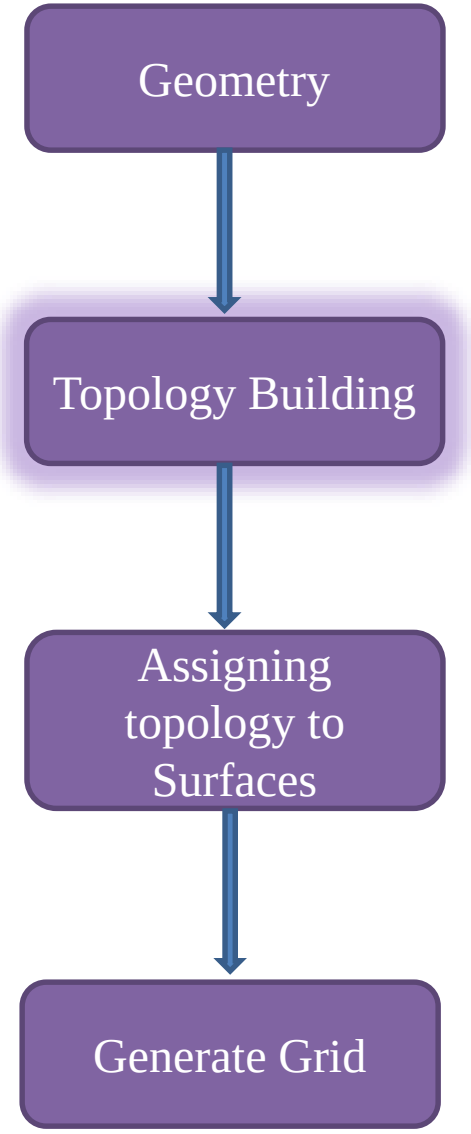

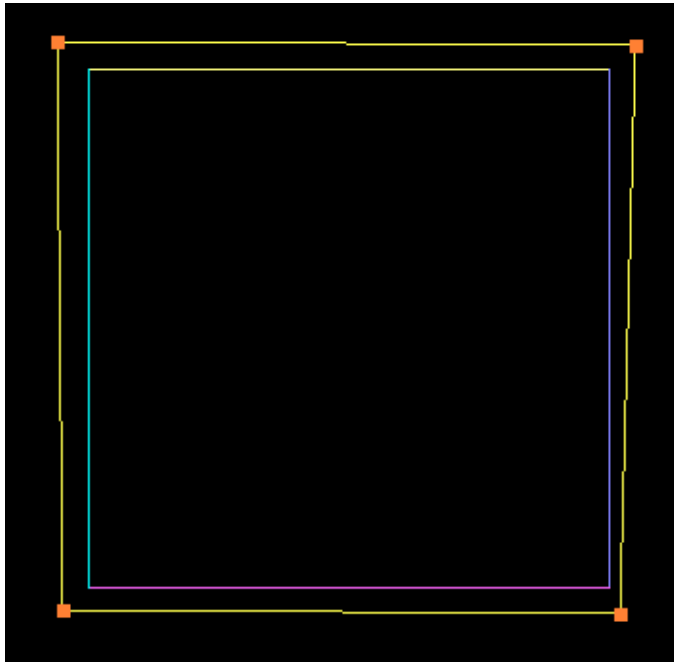

Step 2: Build the block structure

Create topology(corners and edges) that is a coarse hex decomposition of the region. If possible, every surface should be topologically wrapped.

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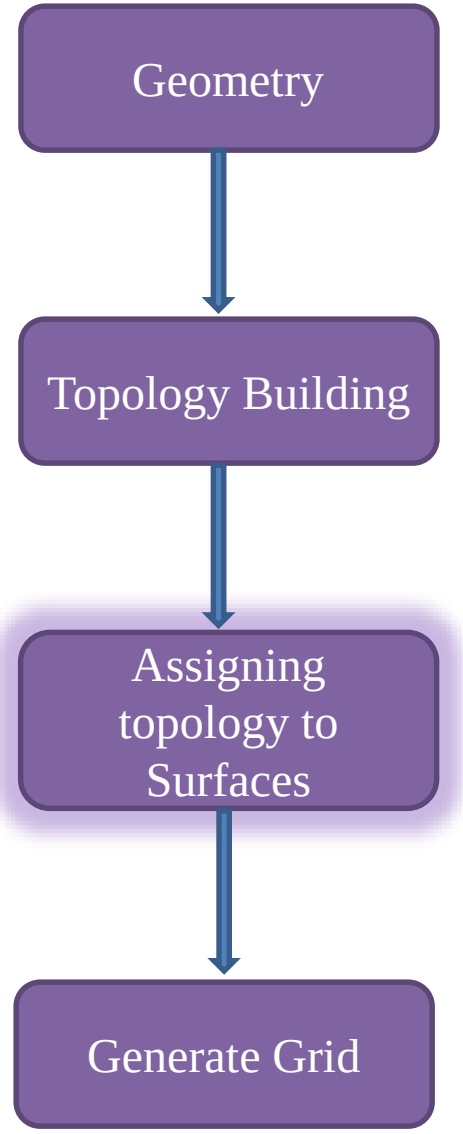
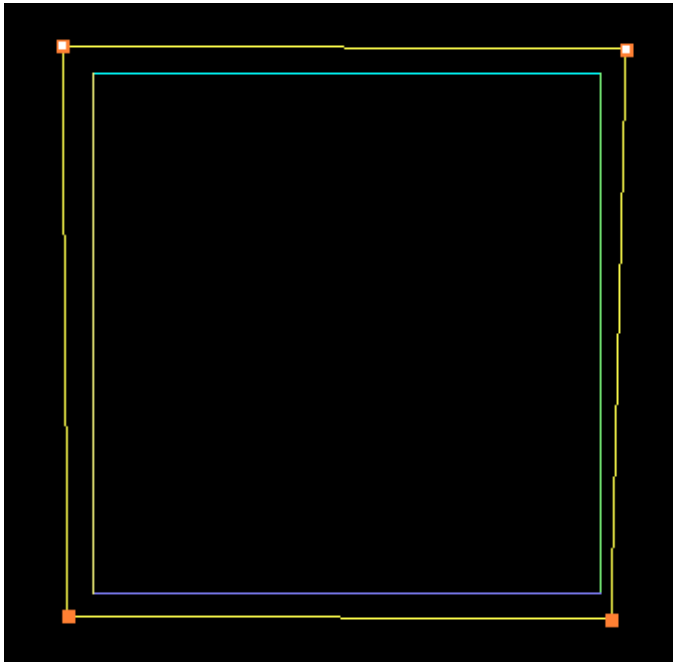
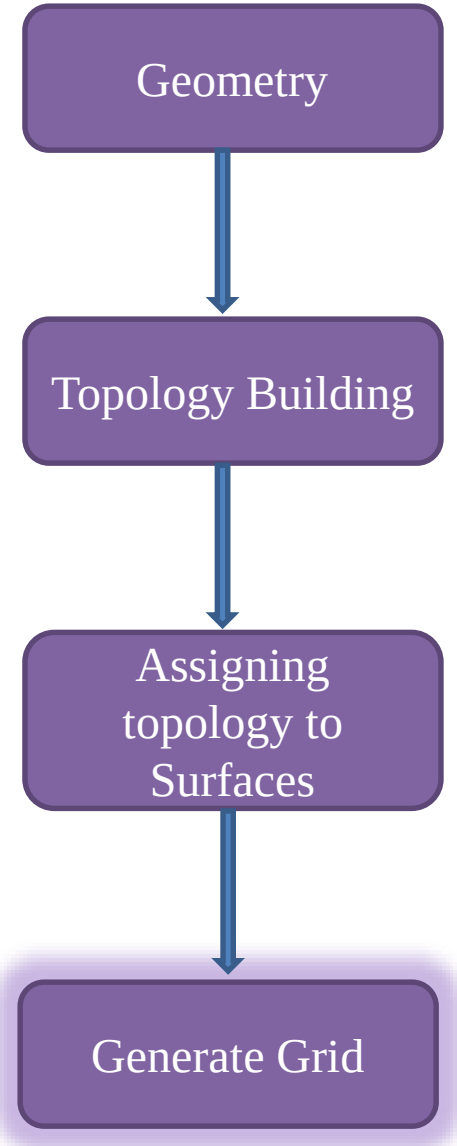


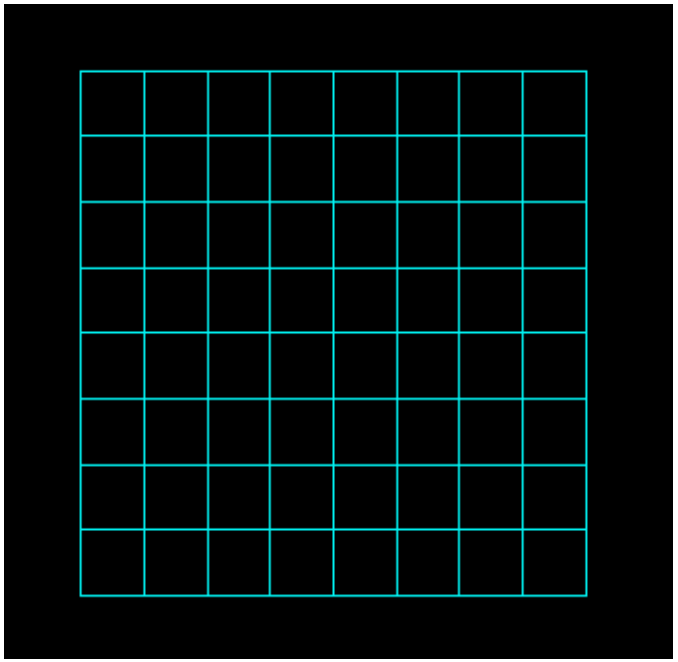


Step 3: Assign the corners to surface

Logically assign corners to intended surfaces. Assign grid densities to edges.

Contd…





Step 4: Create the grid

Launch Ggrid process to debug and generate a grid. View and 'qchk' the grid.

Guidelines for Building GridPro Topology

I. Surface Preparation and Usage:

1. Smoothness: make sure surfaces are smooth. Other qualities such as element shape are less important.

2. Details: use enough elements to resolve the curvature regions.

3. Do not over specify surface with too many elements. Do not specify a surface too much beyond the intended region.

4. Segmentation: the surface should be segmented in a way that is compatible to the topology choices.

5. Do not trim the surface part that is bounded by intersections with other surfaces.

6. Whenever possible, use build-in implicit surfaces over other types and use -tube type over digitized types.

7. Intersection: If two surfaces are supposed to intersect (e.g. a corner assigned to both surfaces), specify the surfaces slightly over the intersection.

8. Intersection: If two surfaces are supposed to intersect, make sure on any intersection point the normals from the two surfaces are not parallel. You can either use additional internal surface on the intersection or make the two surfaces into one to solve the problem.

II. Topology Construction:

- Avoid singular edges on surface:

A KEY rule in determining whether one can use GridPro effectively to generate grids of high quality with robustness.

Resolving singularities :One can always use wrap and/or internal surfaces to remove singular edges on surface.

Detect singularities :The sigularity counting rule for an edge is

singular_level = effective_block_count - 2**(2 - effective_surface_count)

Here

effective_surface_count = 0,1,2 and singular_level = 0 means regular.

Without internal surfaces, overlapping surfaces and ribbon sufaces, we have ,

effective_block_count = block_count ,

effective_surface_count = surface_count .

This rule is only a first order consideration, since it is based purely on the topology counting without considering any geometric shapes of the surfaces. For a beginner, this is the minimum (s)he should follow.

- Avoid the use of high degrees of singularities in volume.
- For high curvature regions, place topology on the convex side of the intended surface.
- Run less dense grid first to test out the topology. But the density should be enough to resolve the curvatures. This is a trail and error process.

III. Scale Separation:

1. Use internal surfaces to separate regions of different scales.

2. (e.g.) Define a blade shaped surface as two surfaces, one for each side of the blade. Then use an internal surface to define the separation of the two halves.

IV. Most Encountered Problems:

Causes of Topology Errors

- wrong surface assignments.
- wrong surface sideness (1-sided vs 2-sided).
- isolated or hanging corners or edges.
- forgot to remove x face bars.

Causes of Bad Grids.

- surfaces do not intersect.
- topology cuts surface on the concave side.
- wrong surface orientation.
- not enough grid density for curvature.
- need more sweeps.
- surface assignments wrong.
- singular edges on surfaces.
- no internal surface for scale separation
- bad topology design.