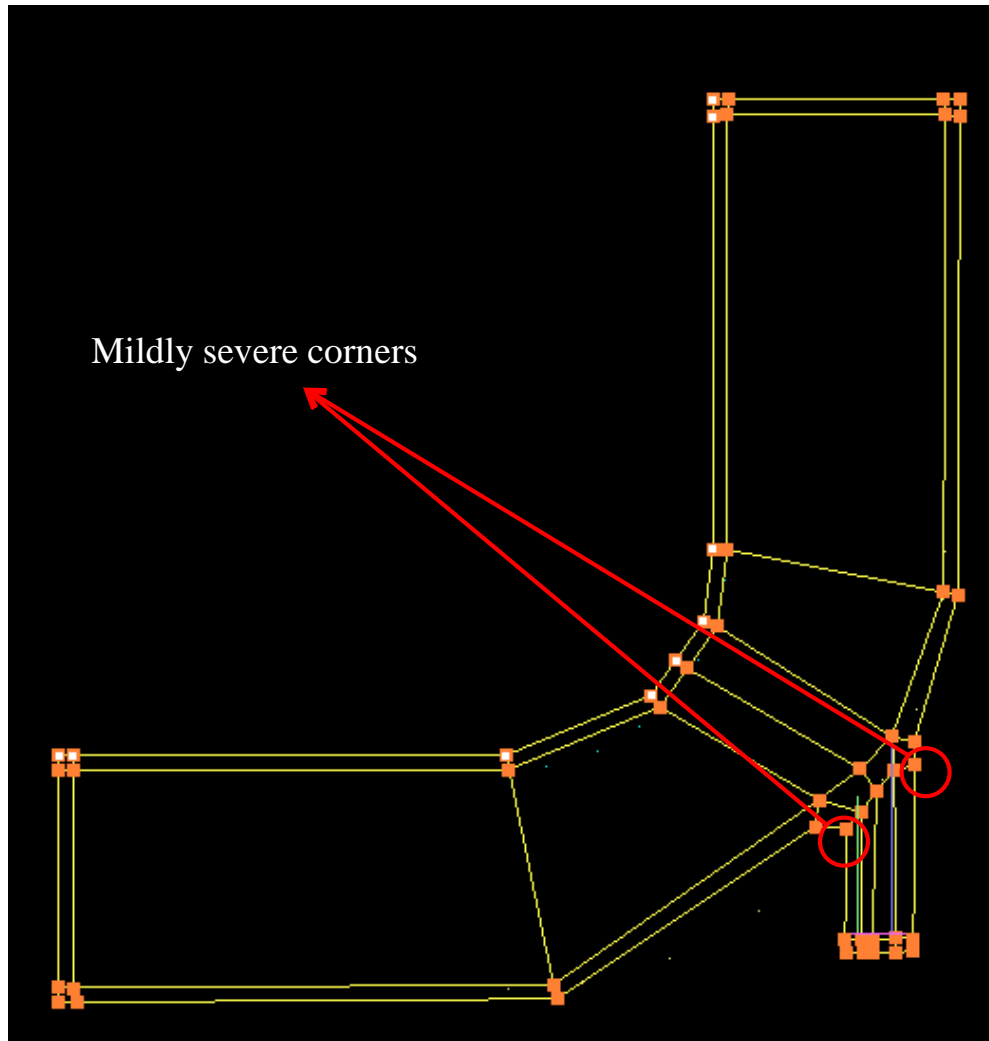


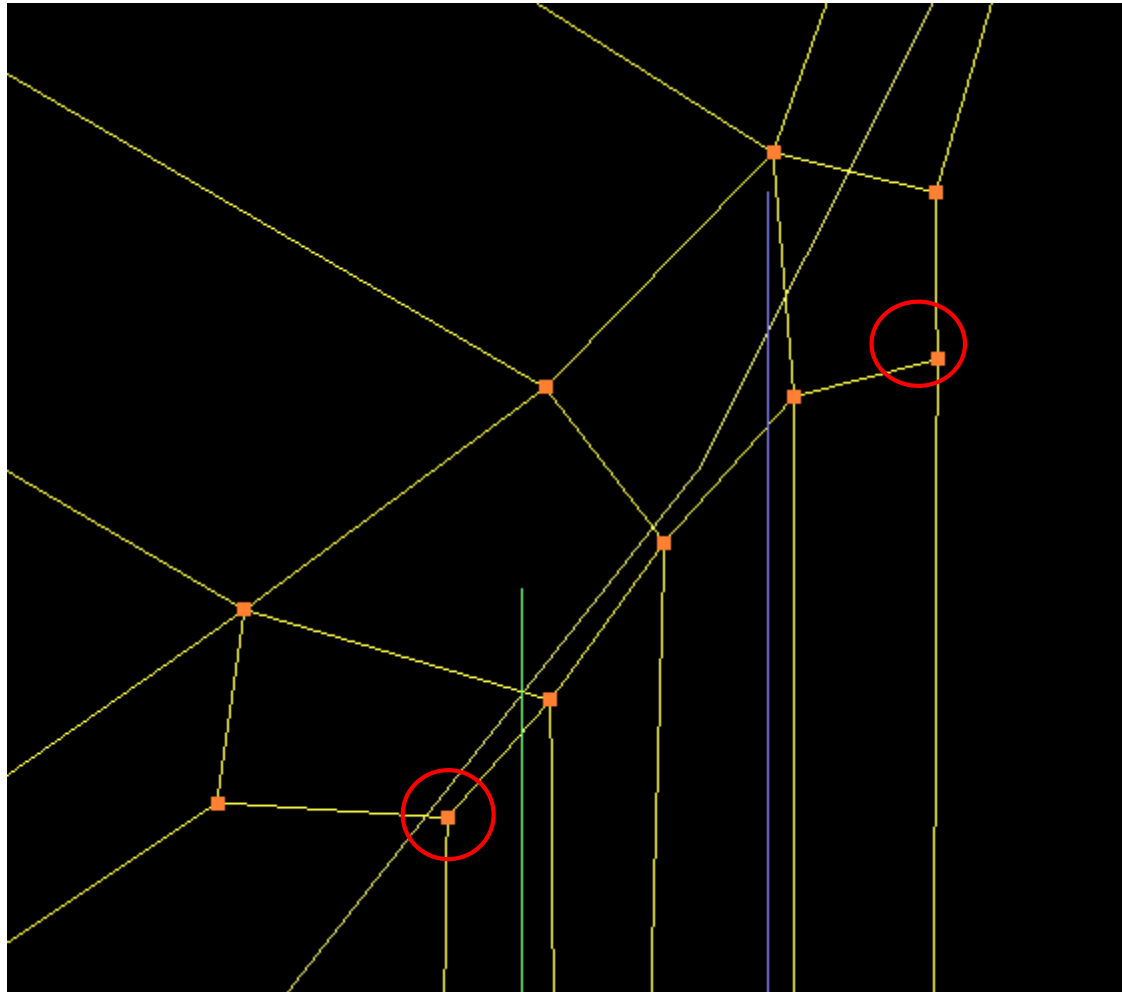
Mildly Severe Singularity



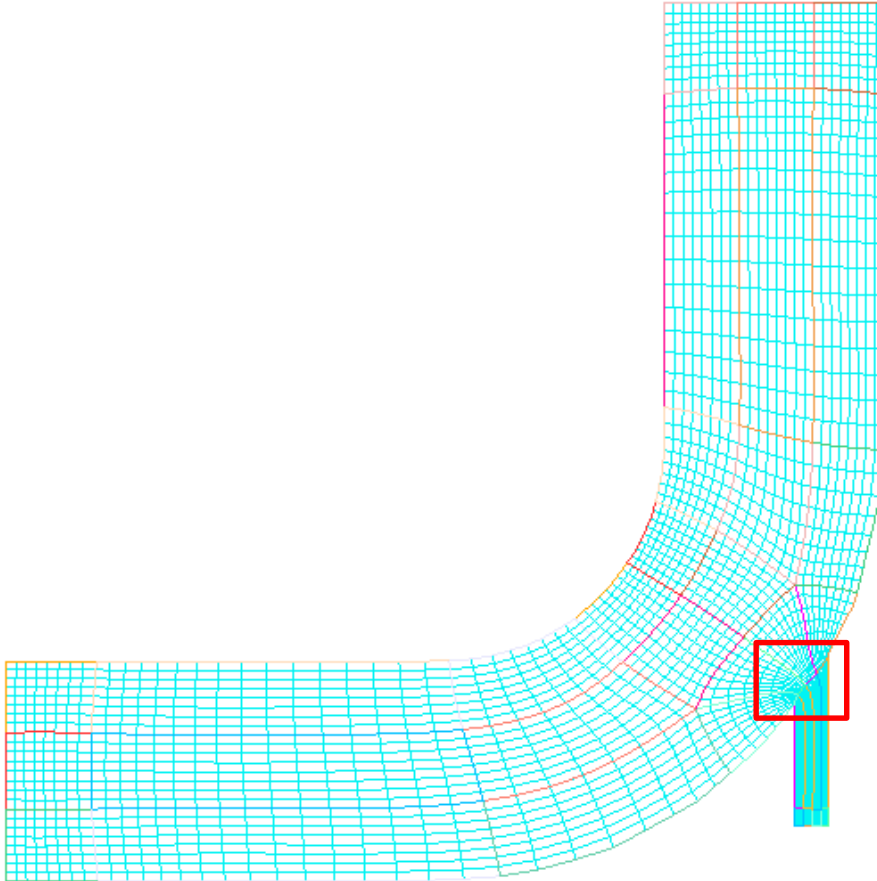
- What leads to a Mildly Severe Singularity?

If a corner/edge is fixed by assigning to more than one surface. And the edge emerging from that fixed point/edge is free to move, then it is called mildly severe singularity.

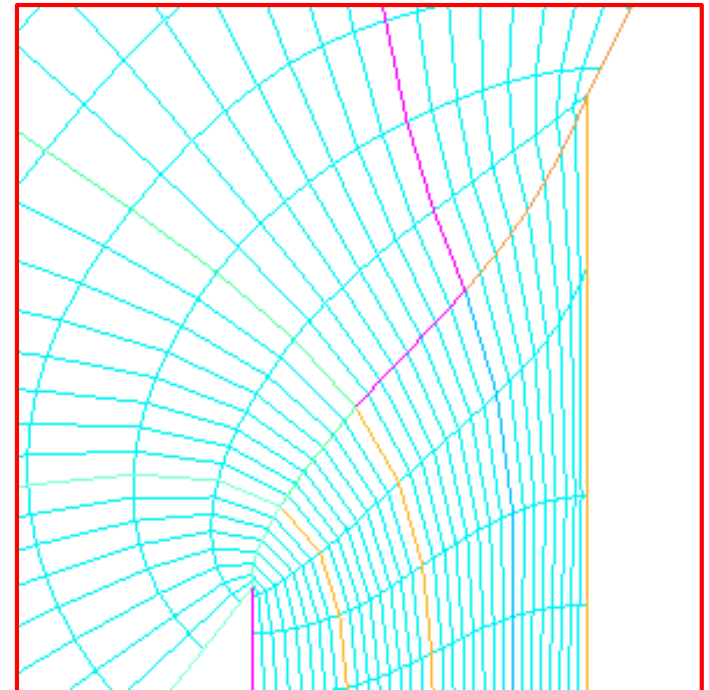
Contd...



Contd...

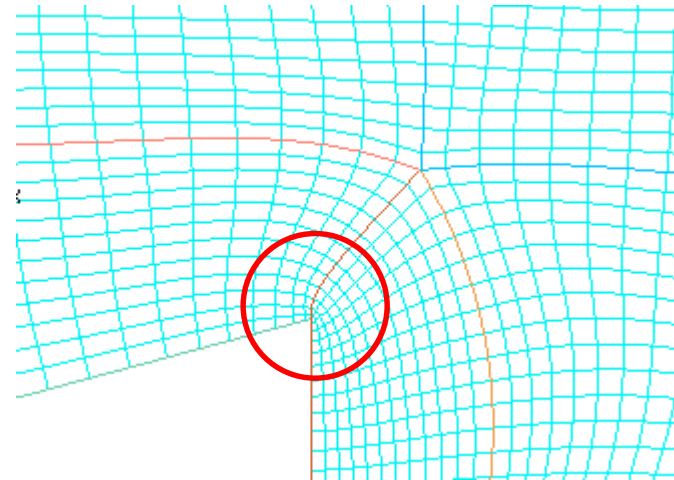
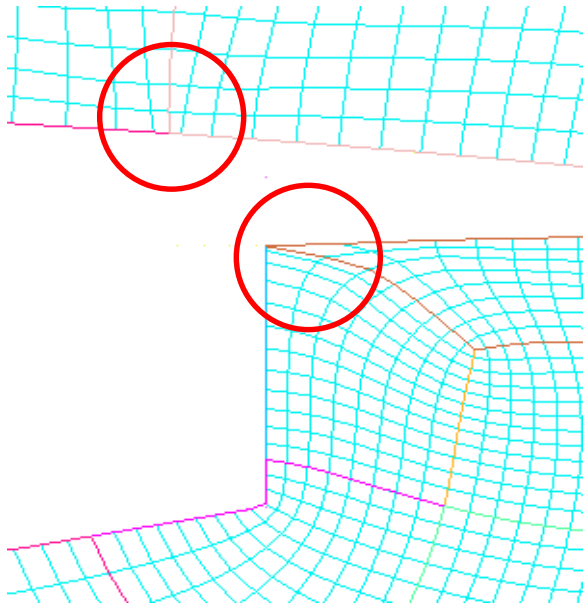


- Mildly severe singularity behaves very badly which will result in either highly skewed grid or folds.

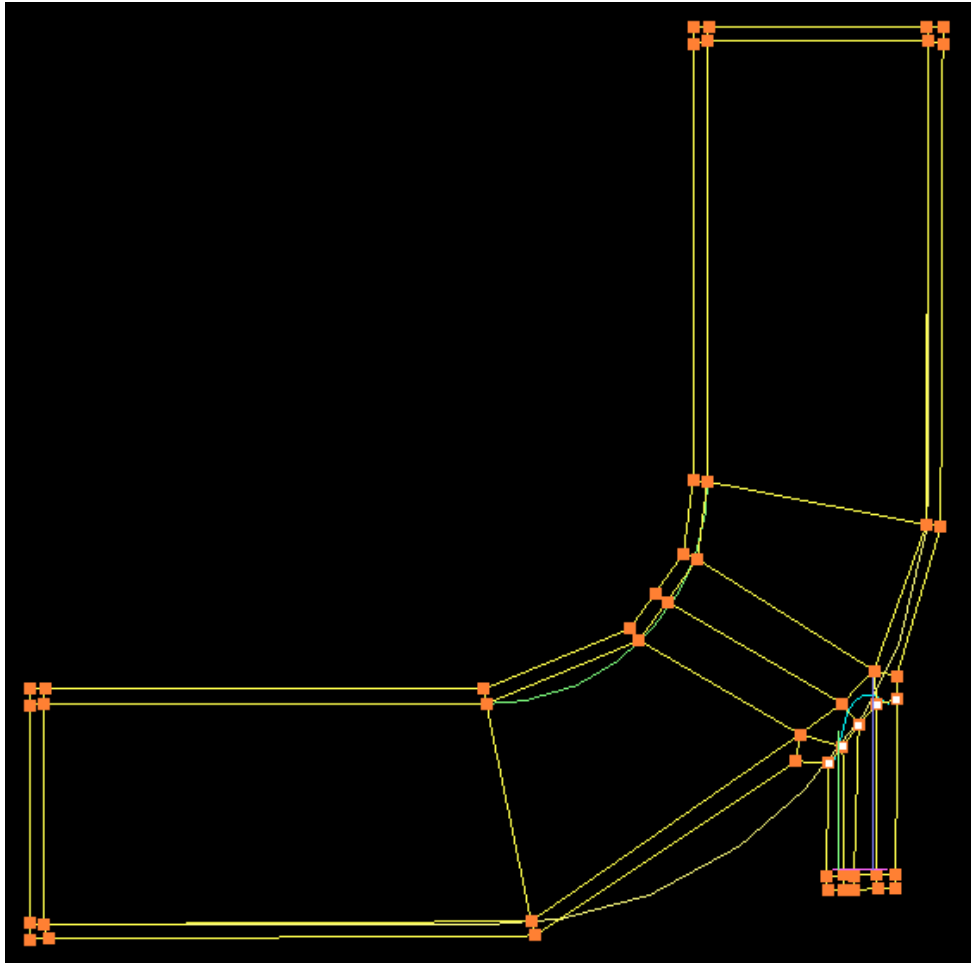


Contd...

EXAMPLE CASES:



Contd...



- Mildly severe singularity on a convex region can be solved by freezing the freely moving corner using an extra surface which has to be created in GridPro by the user manually depends on the geometry.
- This new surface will guide the freely moving corner and outputs a good grid. This surface is called as internal surface.

INTERNAL SURFACE:

An internal surface is a surface for which both sides of the surface are to be gridded. An internal surface can be specified with any surface type that can be used for an external surface. However, the orientation of the surface must be suppressed with the -O in the surface definition statement. The grids on both sides of an internal surface will be matched on the surface. A typical example is the wake of flow over an air foil.

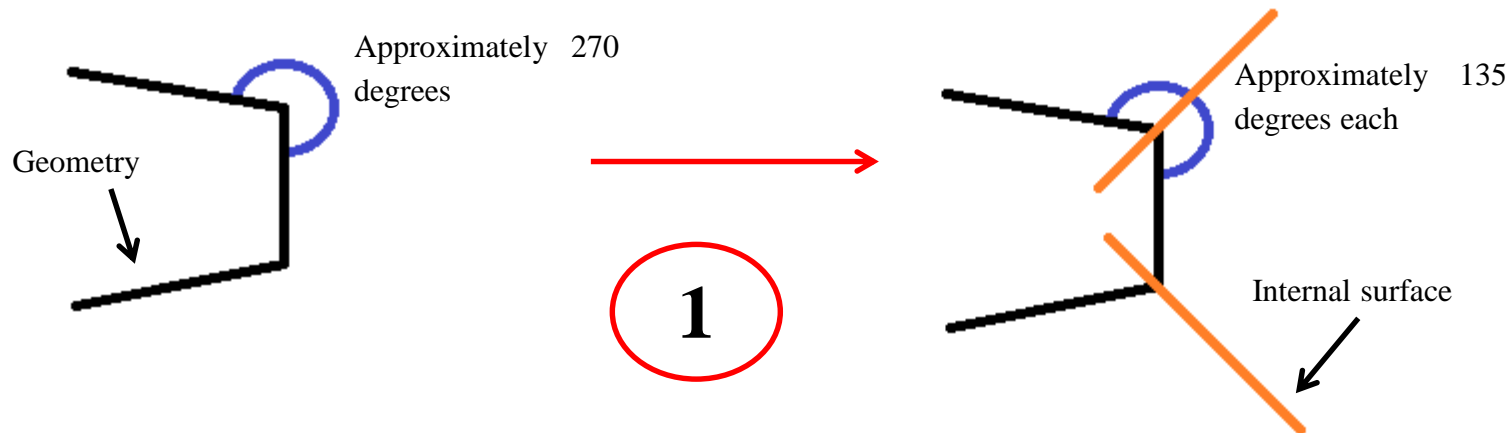
How should the internal surface be???

1. It should be a smooth surface. To obtain a high grid quality, it is desirable to have internal surfaces relatively flat.
2. It should be created with the final grid in mind. Since the block boundaries will be assigned to the internal surface, the grid lines would align itself along the internal surface.

Contd...

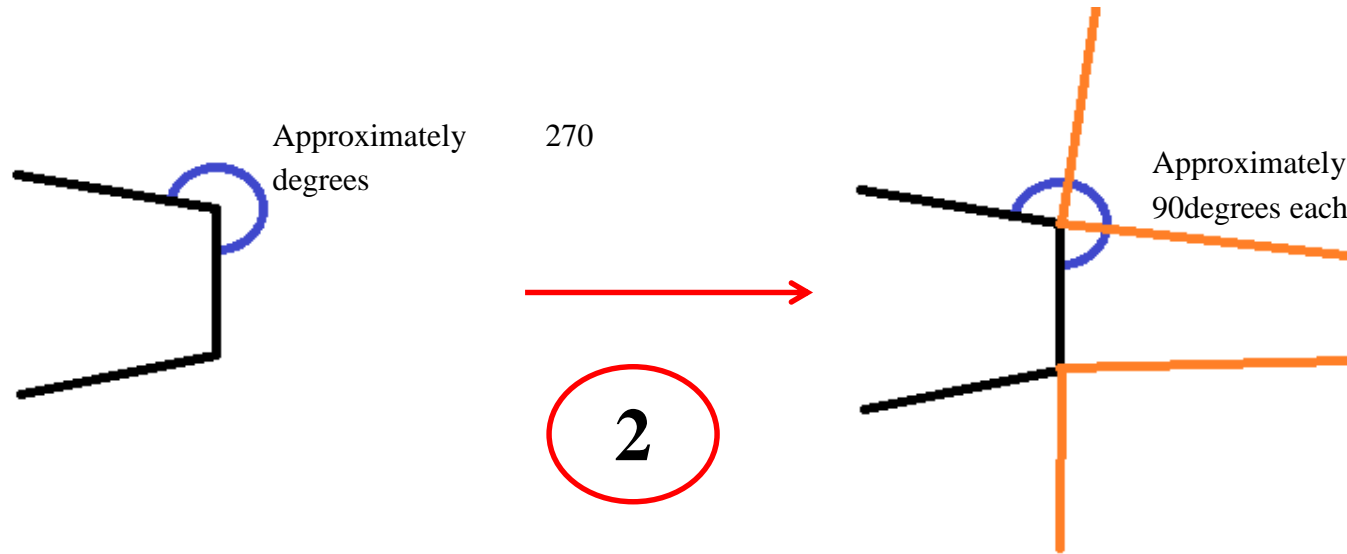
What kind of internal surface should I create?

The slides below show what needs to be done/which parameters need to be considered before building an internal surface.



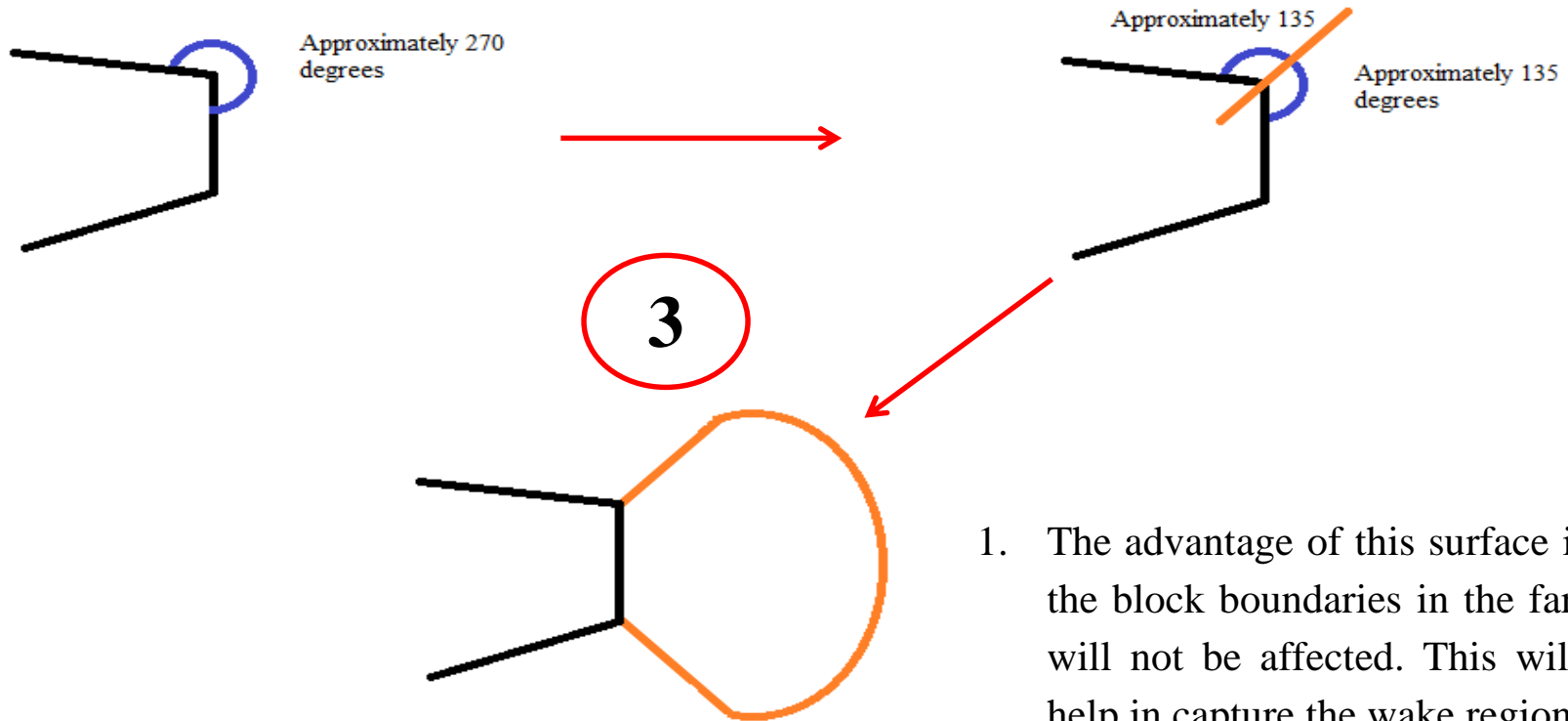
The advantage of this kind of surface is that it is easy to create. The downside of it is that the internal surface should extend till the far-field boundary. Extending the surface to the far-field boundary results in some limitation in using the nesting feature.

Contd...



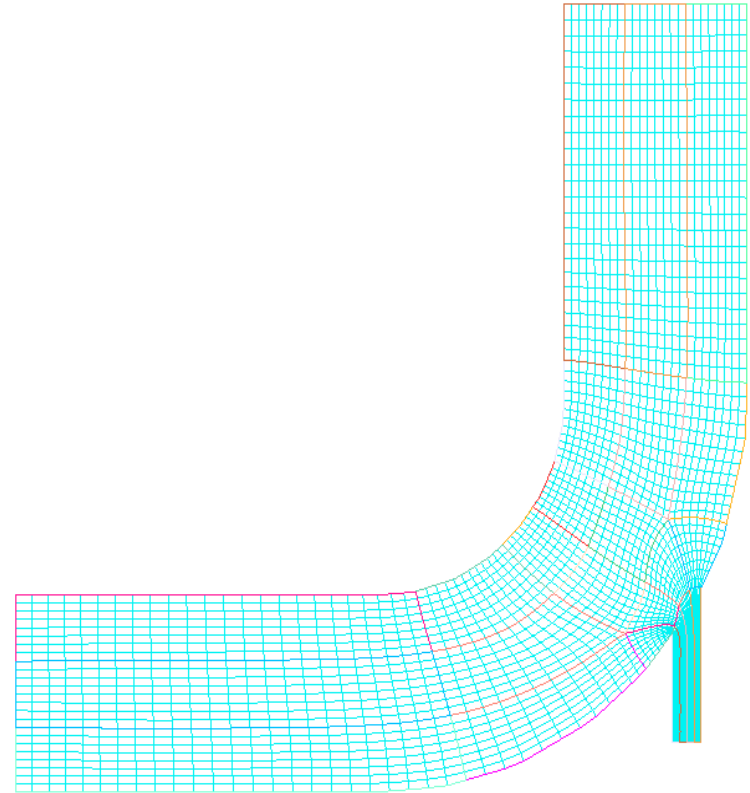
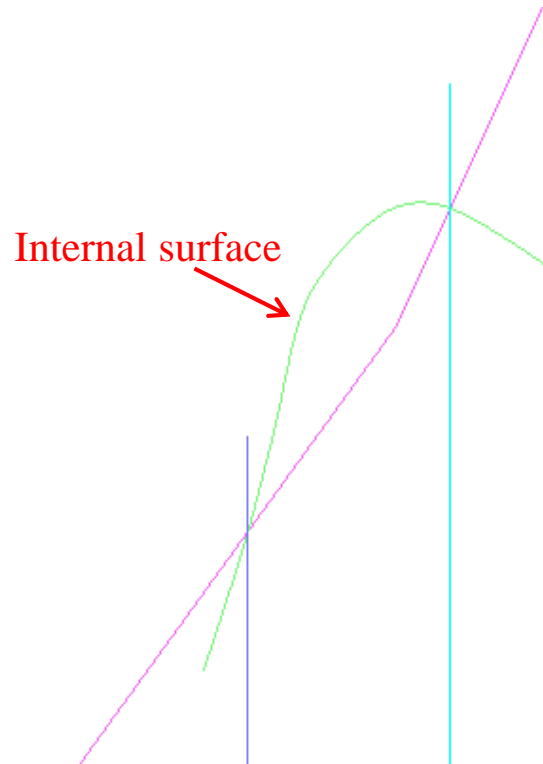
The advantage of this approach is that it is easy to create. The disadvantage of this is that the internal surface should extend till the farfield.

Contd...

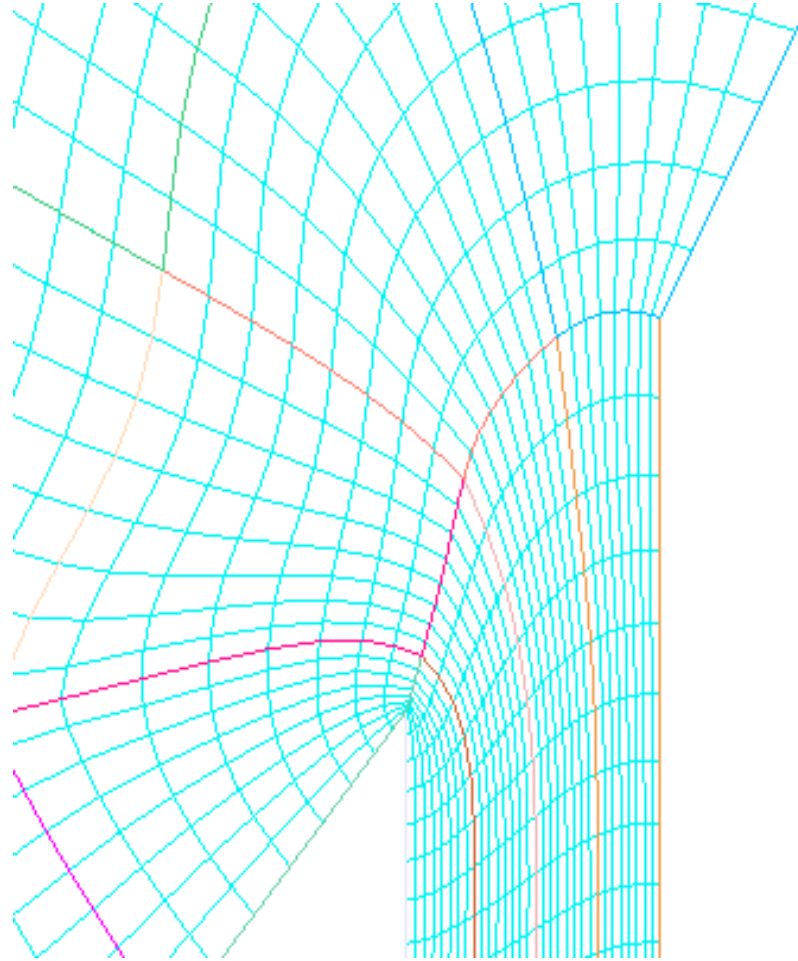


1. The advantage of this surface is that the block boundaries in the far field will not be affected. This will also help in capture the wake region.
2. The disadvantage of this is that the creation of this surface is difficult compare to the other two approaches.

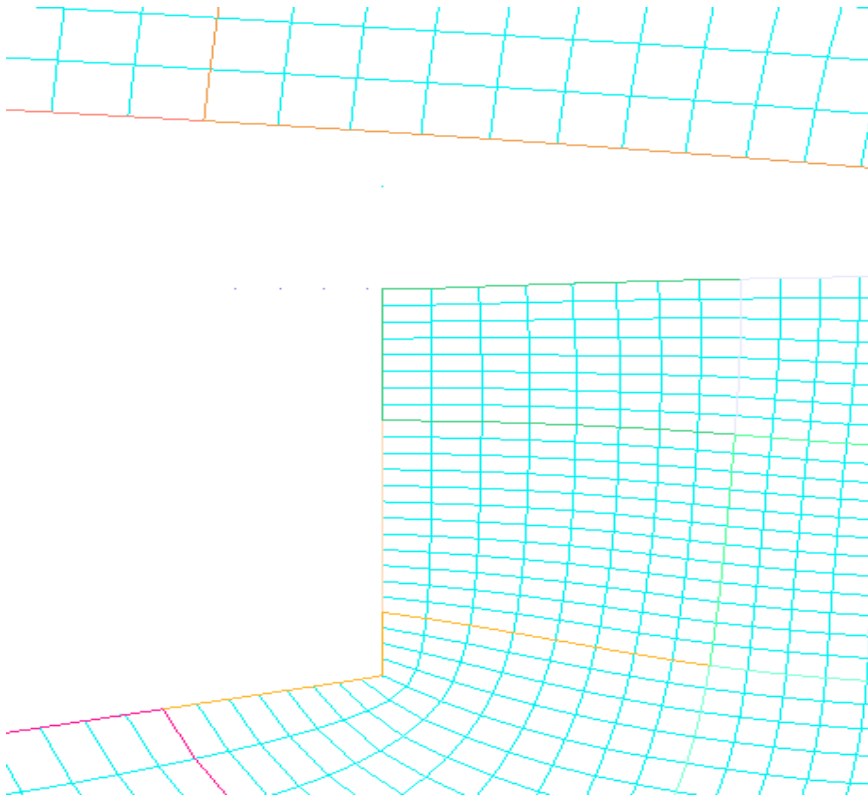
Contd...



Contd...



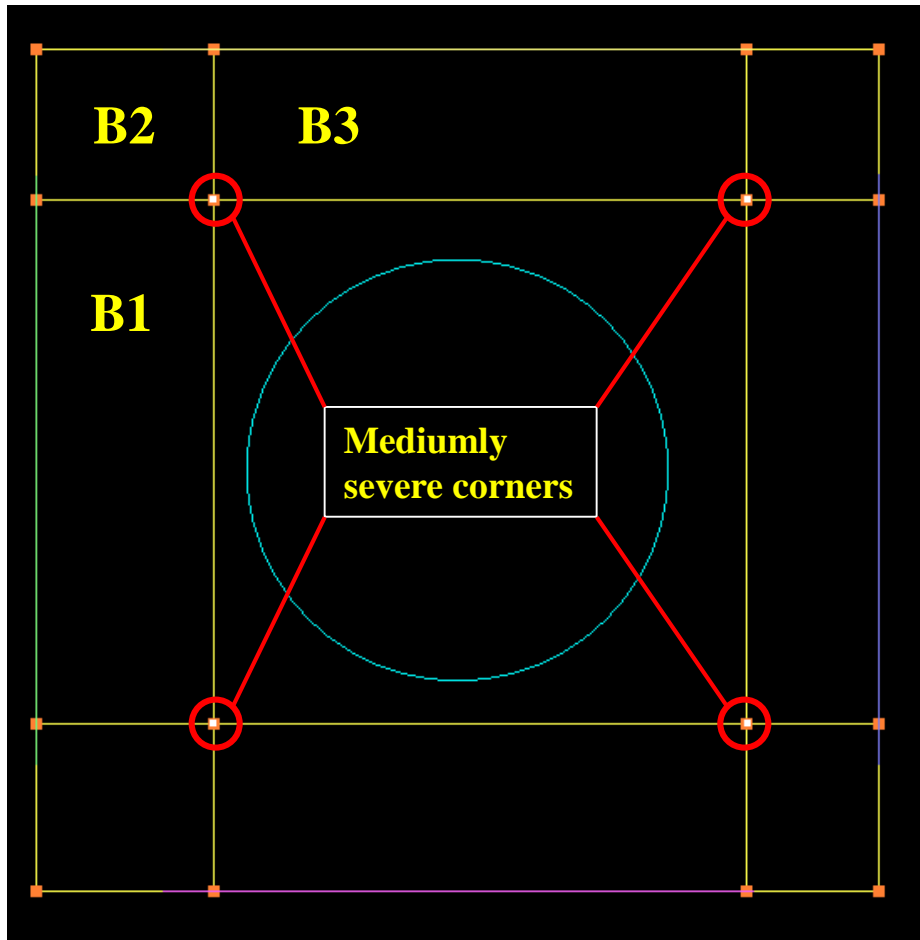
Contd...



In some cases, it can also be solved by overlapping assignments. If two surfaces intersect, a corner is being shared by both the surfaces at the intersection, whereas if overlapping assignments are given, an edge is being shared. If an edge is shared by two surfaces (in 3D, its face), GridPro assumes it as a single surface and hence it will not report it as mildly severe singularity

On a concave region, it can be solved either by density balancing or topology modification.

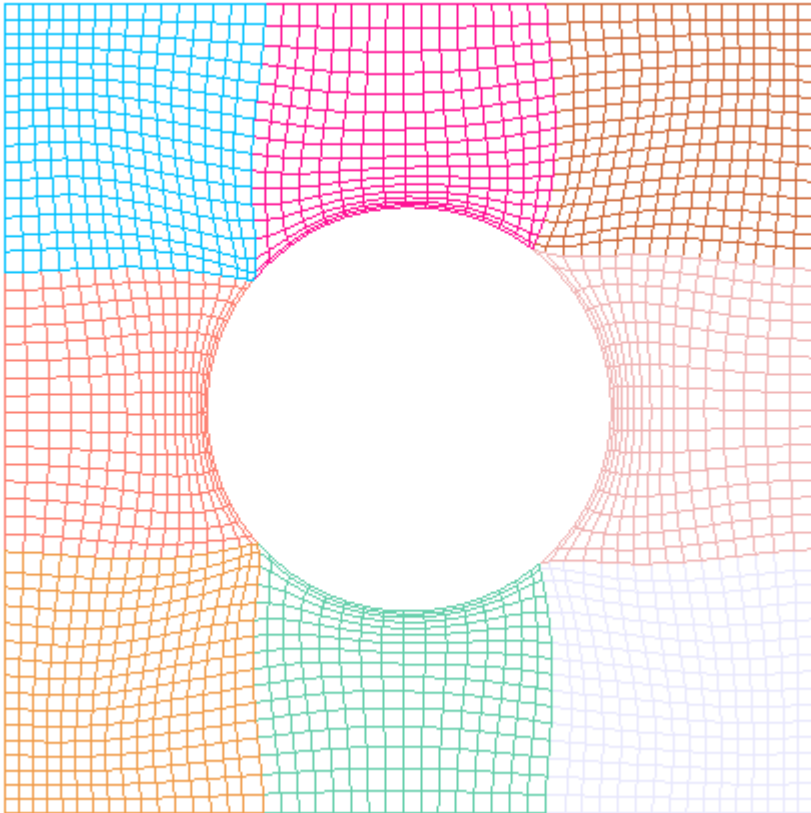
Mediumly Severe Singularity



- What leads to a Mediumly Severe Singularity?

If a non-fixed edge has more than two blocks on one side of the surface, then it is called mediumly severe edge.

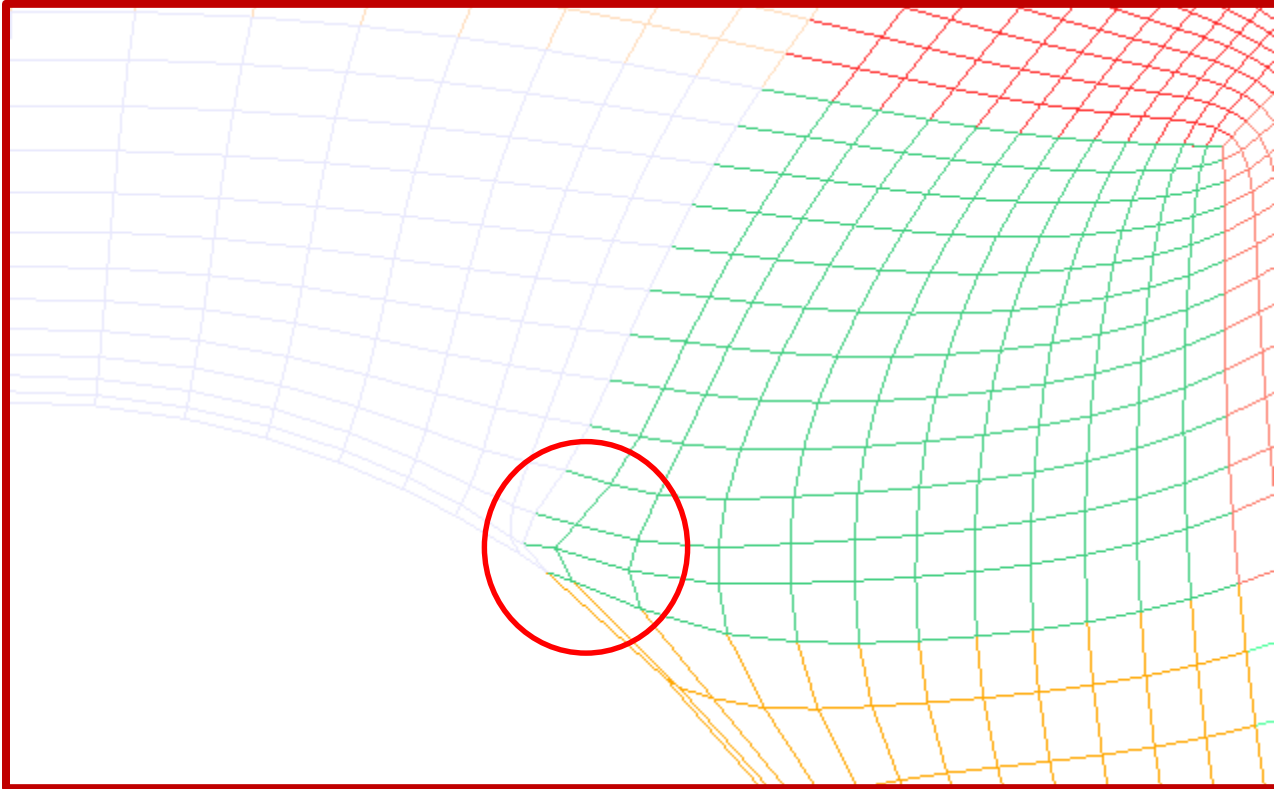
Contd...



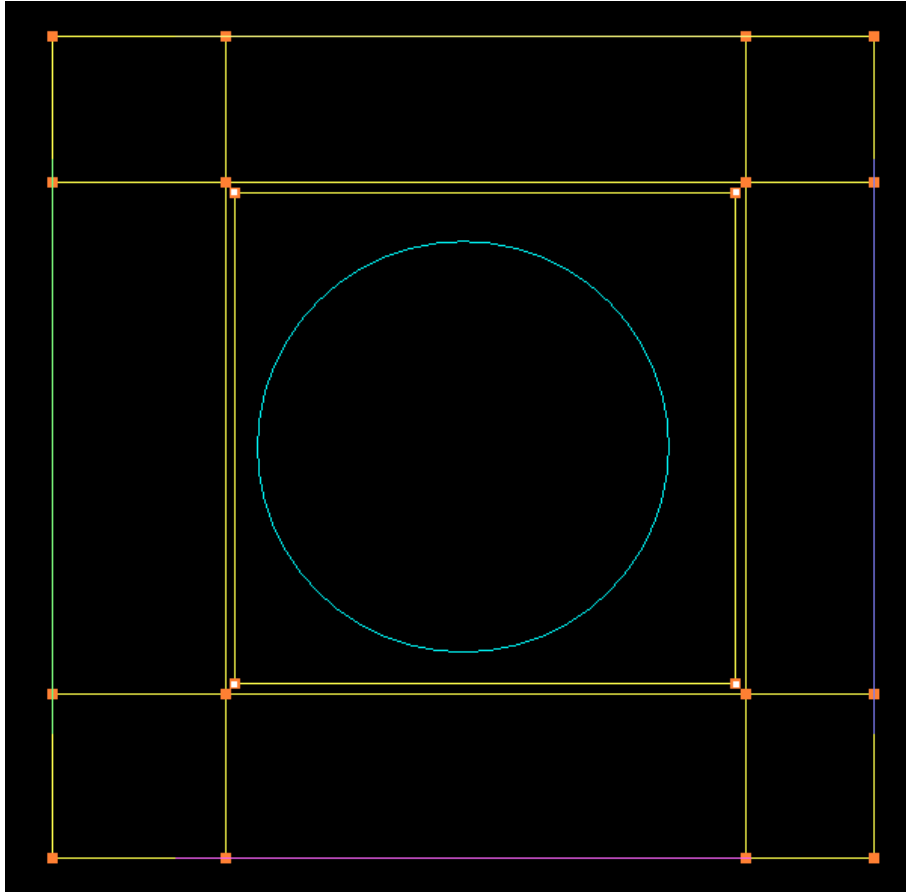
- Since the edge is not fixed, it is free to move (at least on the surface to which it is assigned) and the blocks on one-side of the surface share the 180° angle resulting in skewed grid.

Contd...

EXAMPLE CASES:

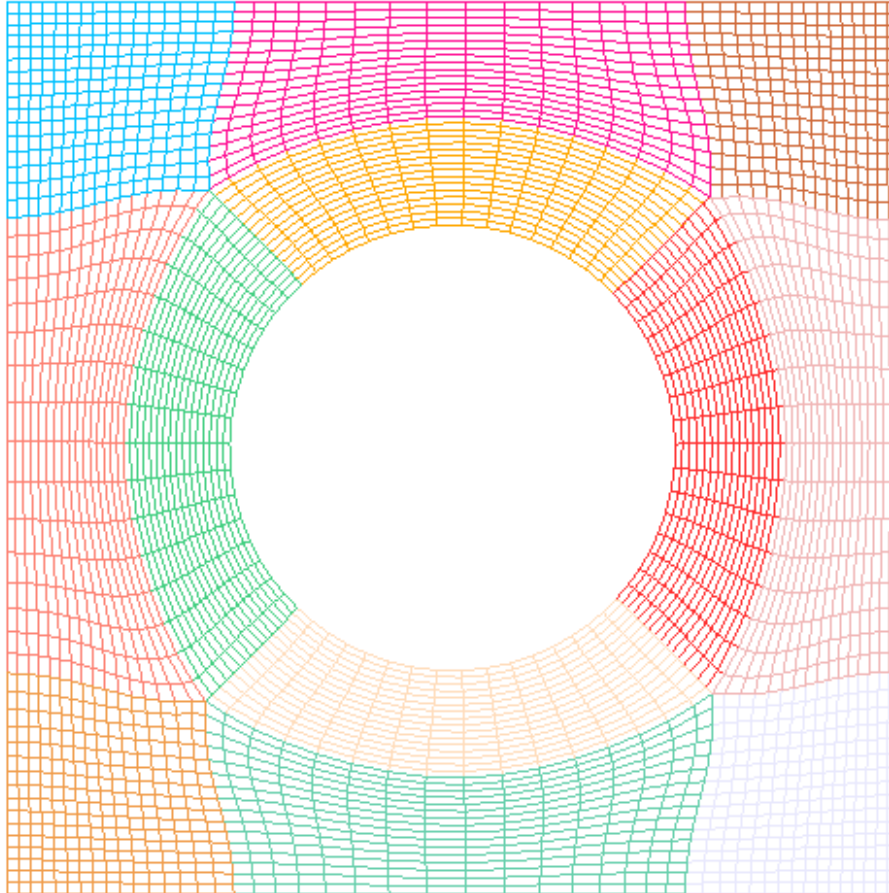


Contd...

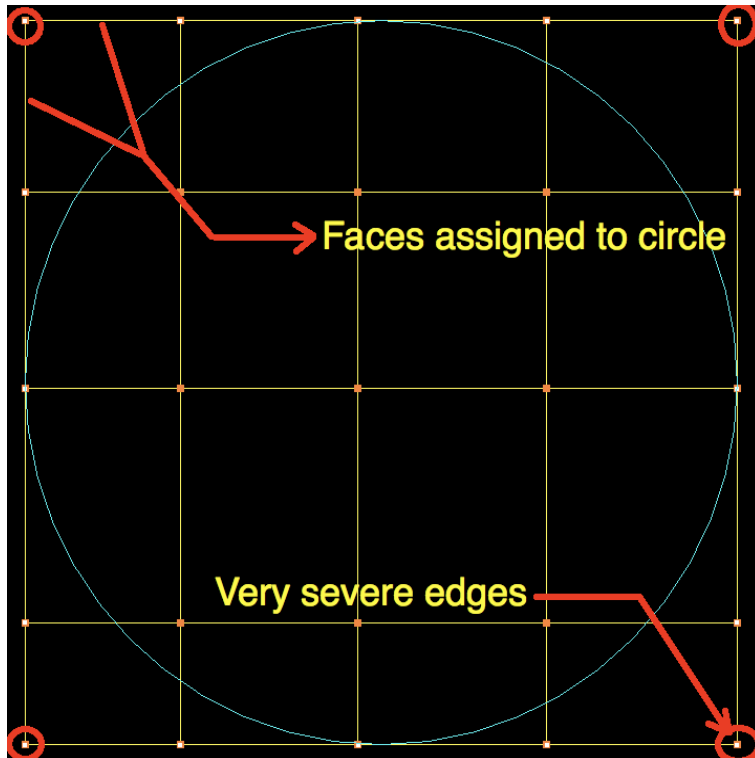


- Doing an internal/external wrap would remove the mediumly severe singularities

Contd...



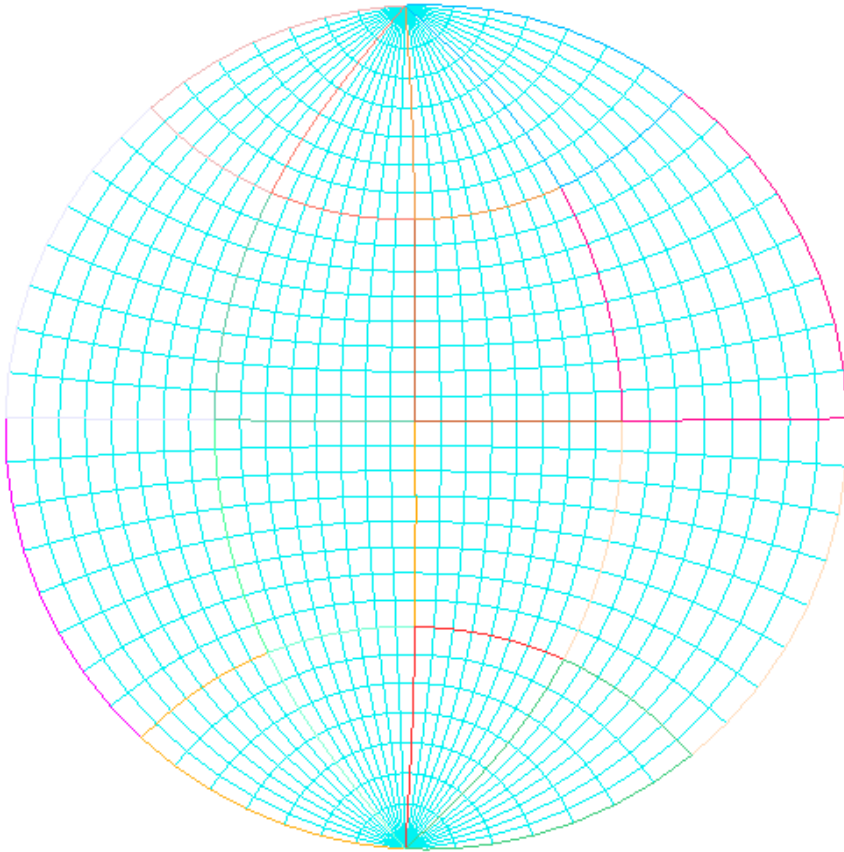
Very Severe Singularity



- What leads to a Very Severe Singularity?

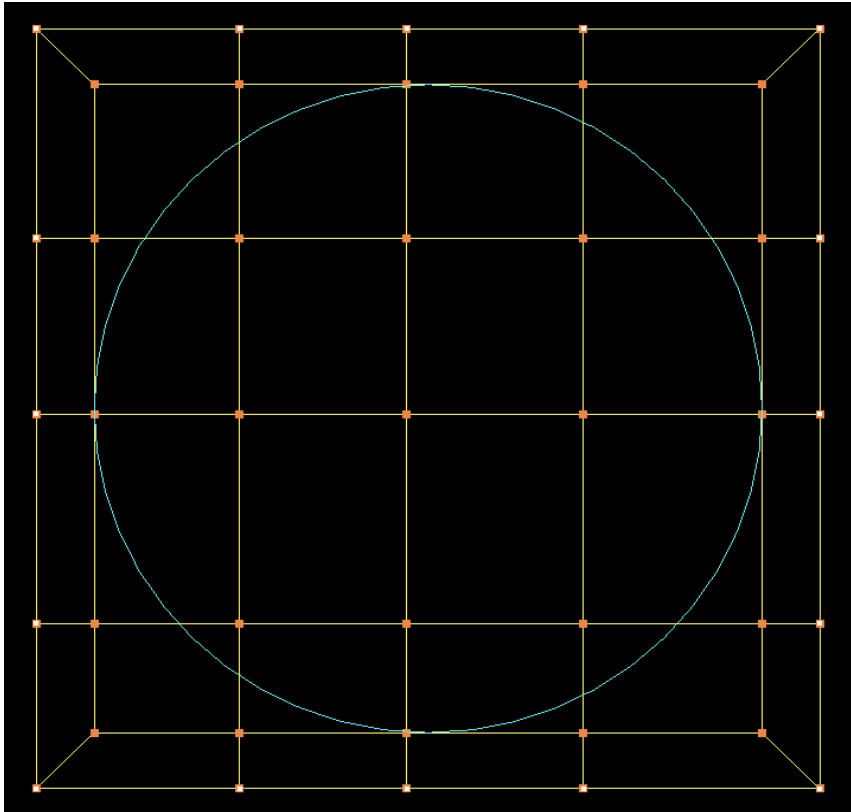
If two faces of a block is assigned to the same surface, then it is called very severe edge.

Contd...



- Since the edge is not fixed, it is free to move (at least on the surface to which it is assigned) and since the two faces share a common block, the block is forced to snap on-to the surface causing a 180° angle at the very severe edge.

Contd...



- Doing a wrap outside would remove this singularity.

Contd...

