Mesh Generation

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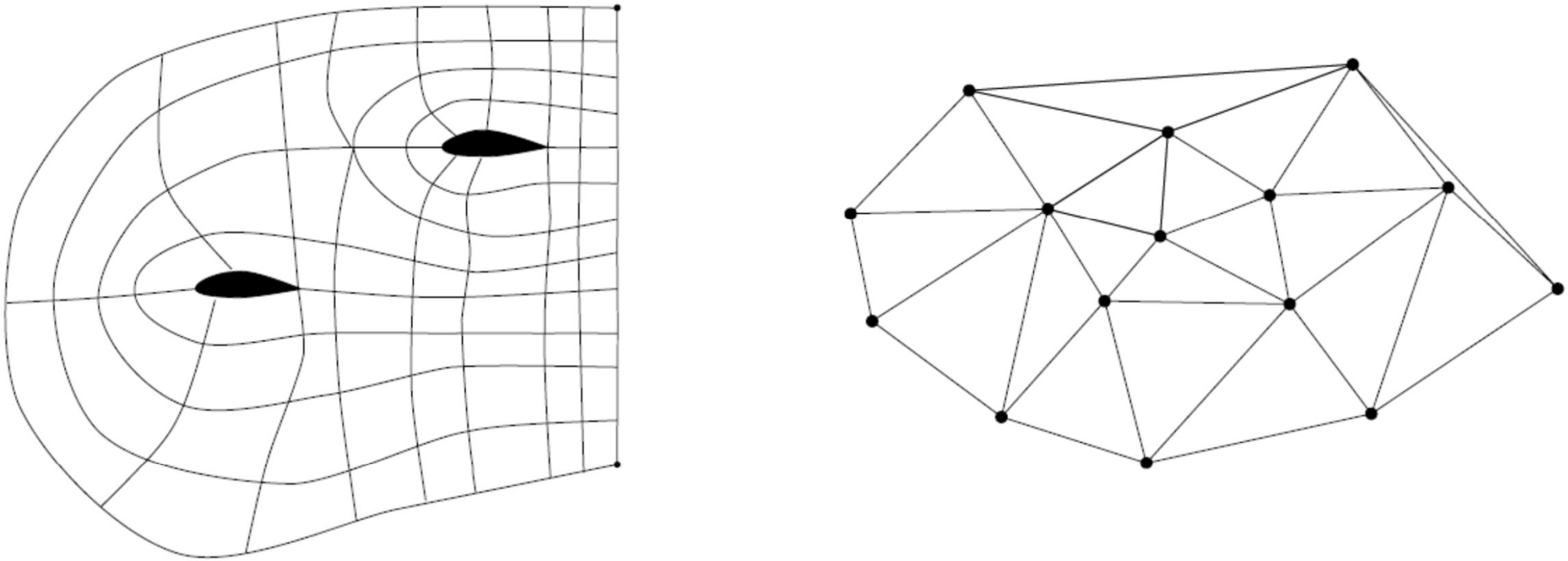
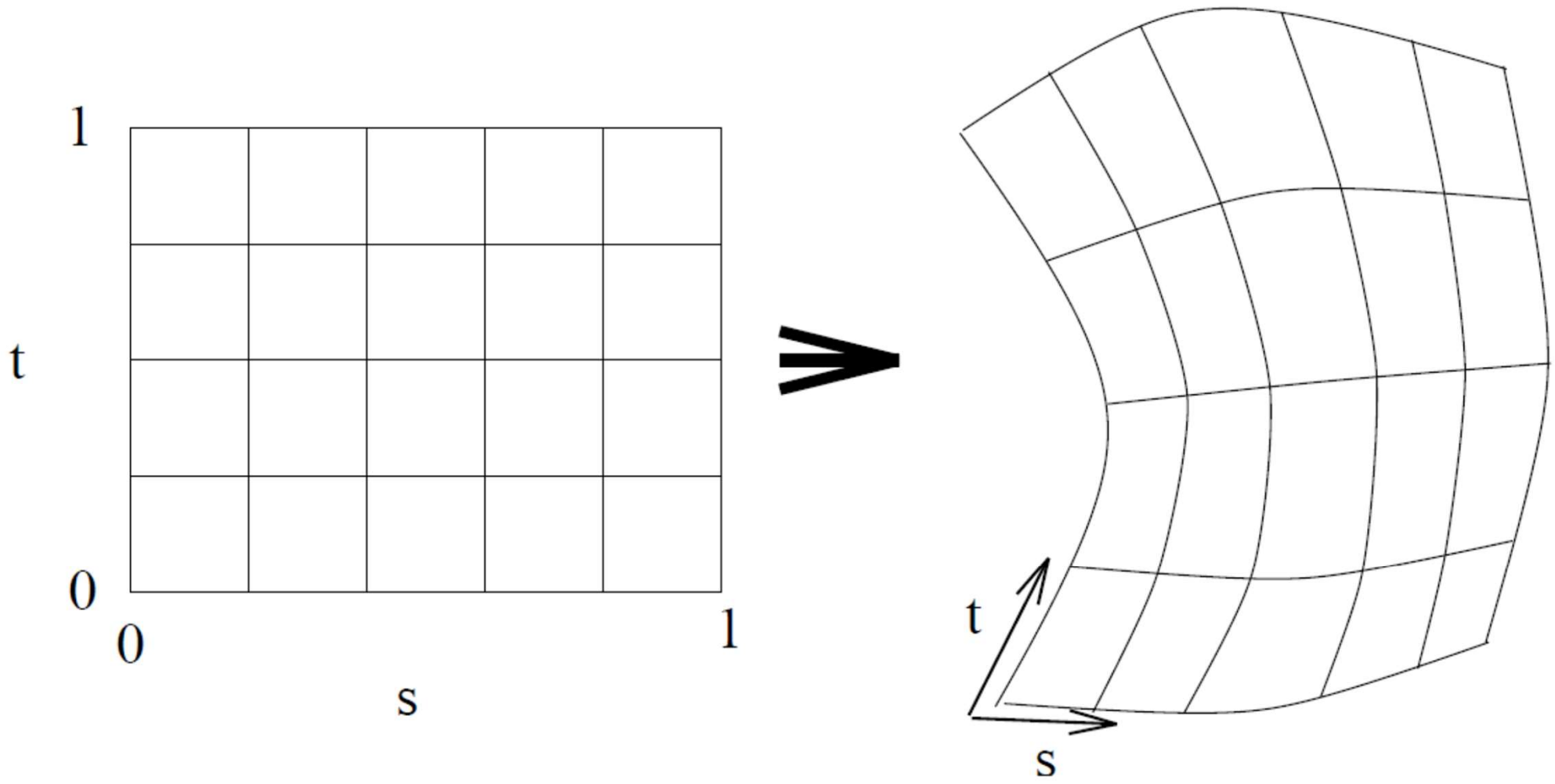
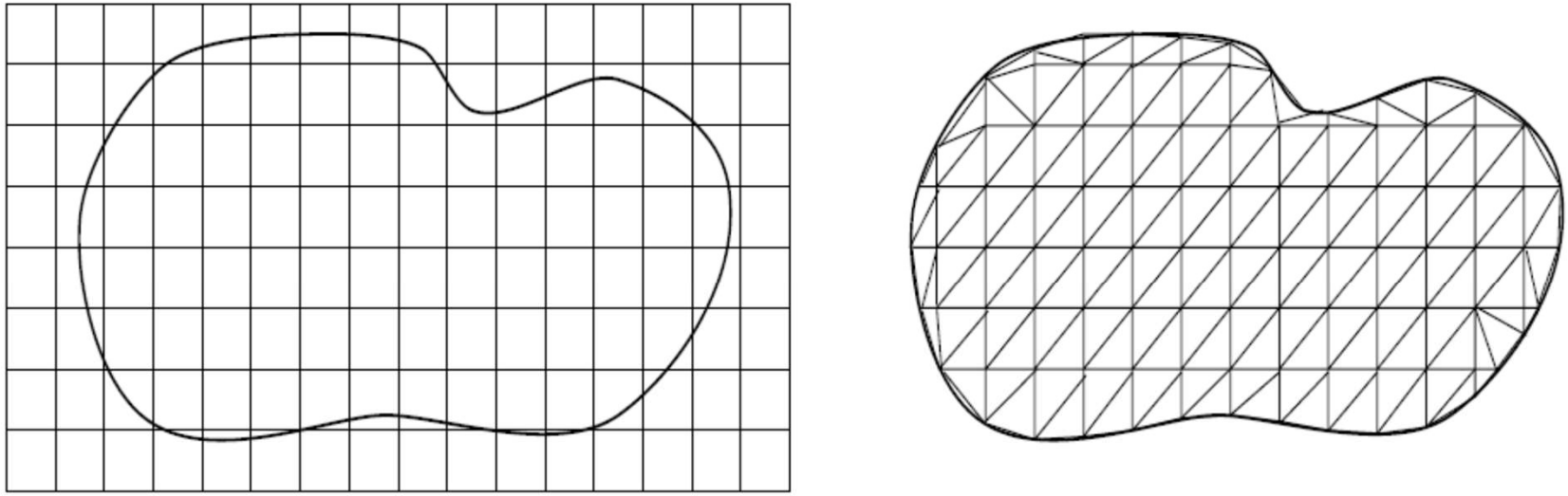


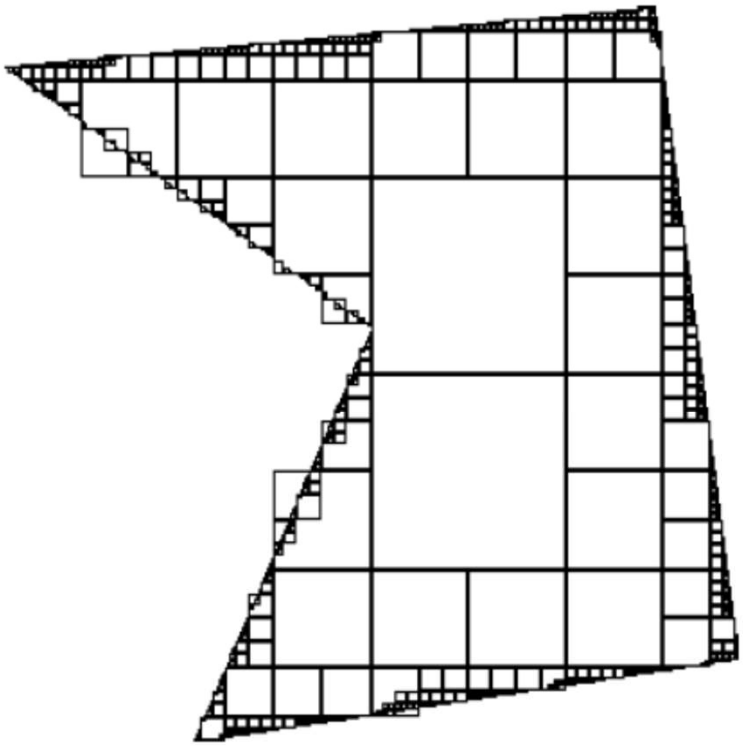
Structured mesh (left) and unstructured mesh (right).



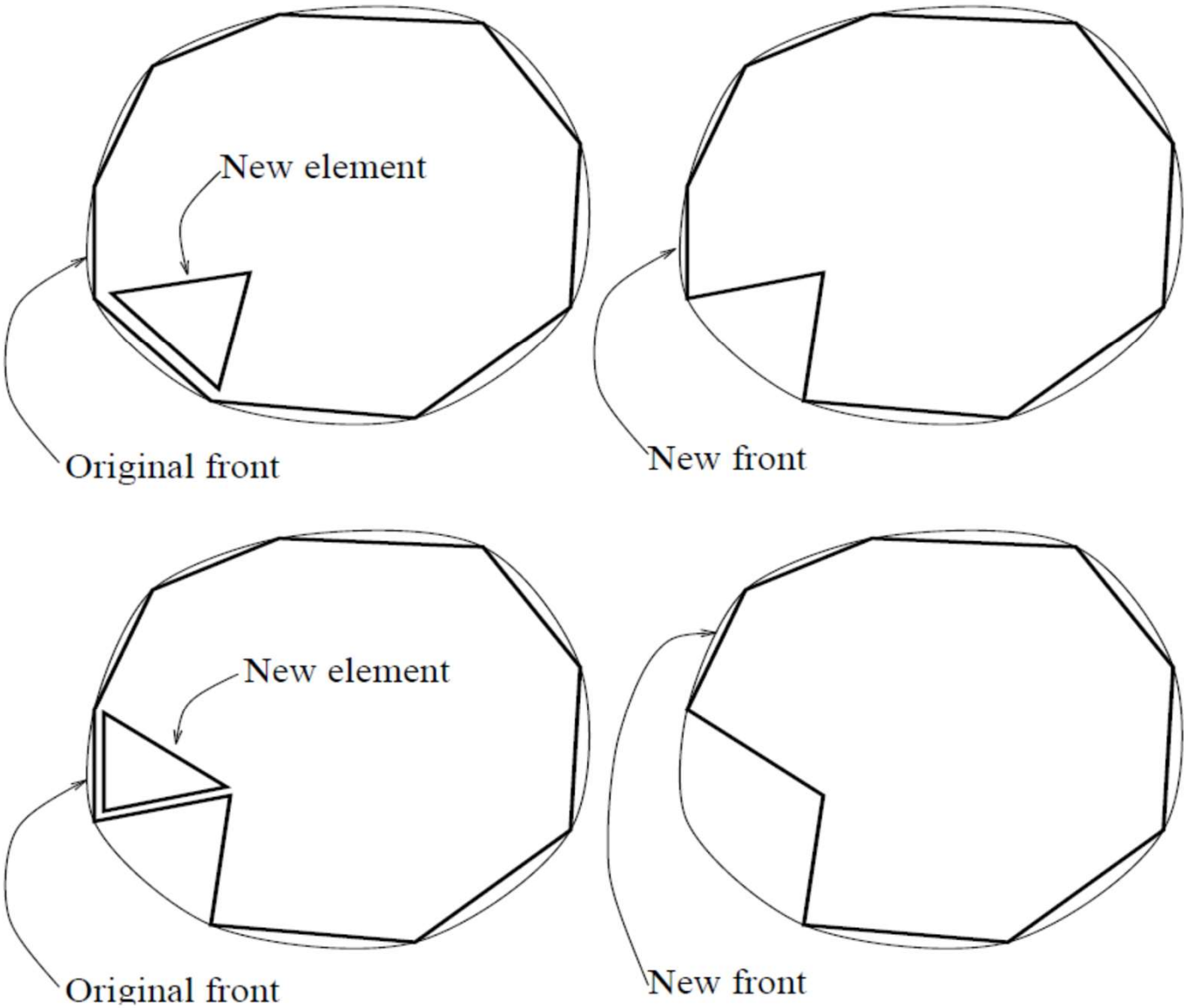
Transfinite interpolation



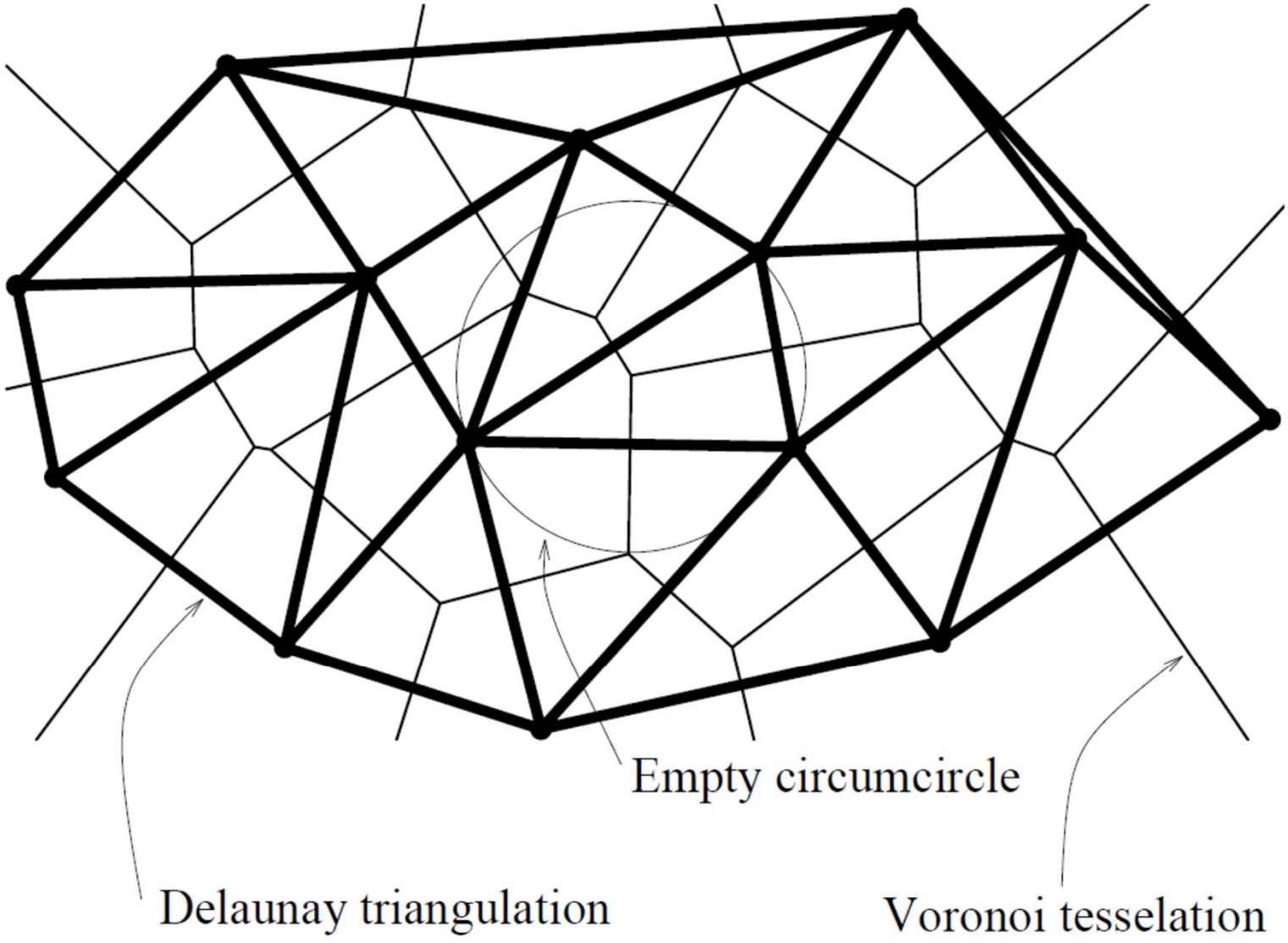
Overlaid grid, cropped, warped to boundary and split into triangles



Quadtree grid, before triangulation and warping



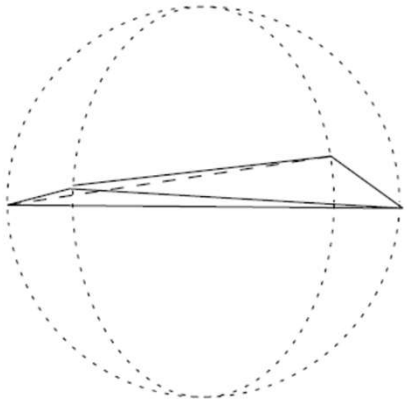
Advancing front



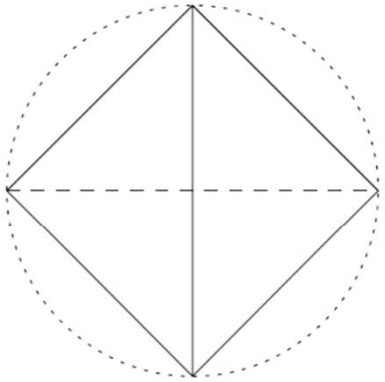
Delaunay triangulation and its dual, the Voronoi or Dirichlet tesselation.

The Delaunay triangulation has two properties that are useful in mesh generation:

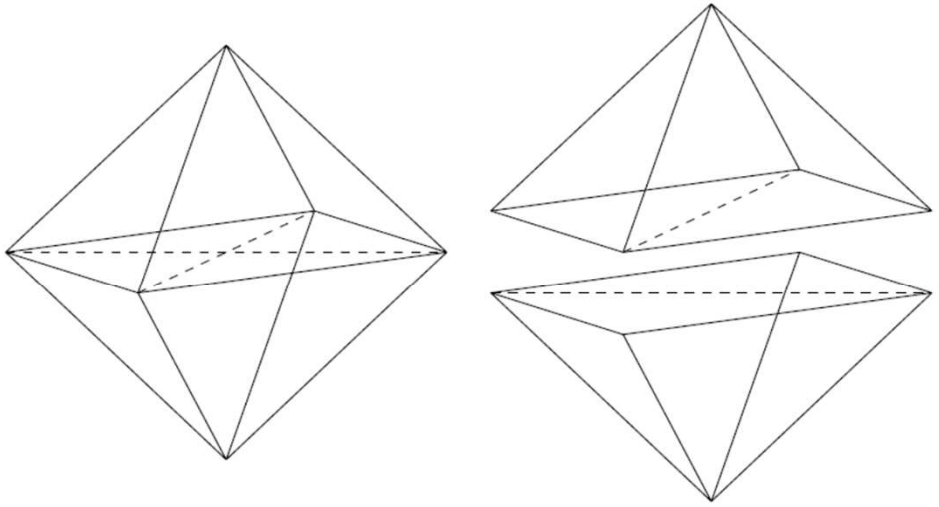
- No point is contained in the circumcircle of any triangle. This 'empty circumcircle' property is used in several Delaunay triangulation algorithms. This property holds in all dimensions; in 3D 'circumcircle of any triangle' is replaced with 'circumsphere of any tetrahedron'.
- In 2D only, of all triangulations, the Delaunay triangulation maximises the minimum angle for all triangular elements. Note that what is required for good quality finite elements is to minimise the maximum angle, but in practical mesh generators (which generate the points as well as the triangulation) the elements generated are of good quality. Unfortunately, this max-min angle property is lost in 3D (and higher dimensions), where very poor quality elements (*slivers*, can be formed.



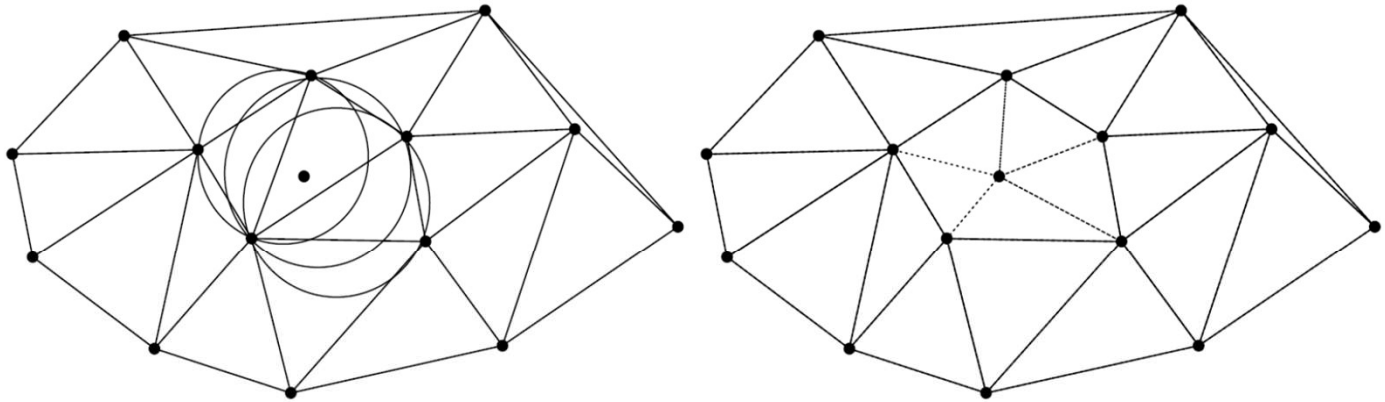
Sliver tetrahedron



Degenerate points, 2D



Degenerate points, 3D



Bowyer-Watson triangulation: circumcircles that contain the new point, and the resulting triangulation