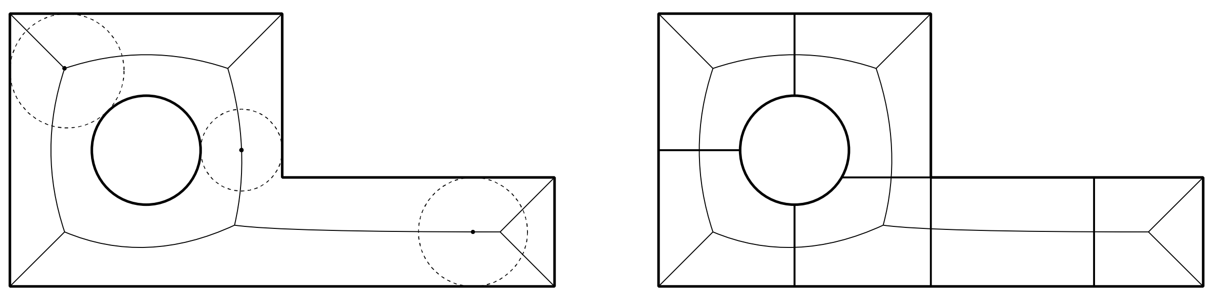
finite element modeling group at Queens University in Belfast (C. Armstrong). Their strategy is to automate the block decomposition process. The starting point is the derivation of a simplified geometrical representation of the geometry, the medial axis in 2D and the medial surface in 3D. In the following we will explain the idea (see [Price, Armstrong, Sabin 1995] and [Price and Armstrong 1997] for the details).

We start with a discussion of the 2D algorithm. Consider a domain A for which we want to find a partition into subdomains A_i. We define the *medial axis* or skeleton of A as follows: For each point $P \in A$, the touching circle $U_r(P)$ is the largest circle around P which is fully contained in A. The medial axis $M(A)$ is the set of all point P whose touching circles touch the boundary δA of A more than once.

Figure 7: Medial axis and domain decomposition



The medial axis consists of nodes and edges and can be viewed as a graph. An example is shown in fig. 7: Two circles touch the boundary of A exactly twice; the respective midpoints fall on edges of the medial axis. A third circle has three common points with δA, the midpoint is a branch point (node) of the medial axis. The medial axis is a unique description of A: A is the union of all touching circles $U_r(P), P \in M(A)$.

The medial axis is a representation of the topology of the domain and can thus serve as a starting point for a block decomposition (fig. 7 and 8). For each node of $M(A)$ a subdomain is defined, its boundary consisting of the bisectors of the adjacent edges and parts of δA (a modified procedure is used if non-convex parts of δA come into play [Price, Armstrong, Sabin 1995]). The resulting decompostion of A consists of $n-$polygons, $n \geq 3$, whose interior angle are smaller than 180^o. A polygon is then split up by using the midpoint subdivision technique [Tam and Armstrong 1993], [Blacker and Stephenson 1991]: It's centroid is connected to the midpoints of it's edges, the resulting tesselation consists of convex quadrilaterals. Fig. 8 shows the multiblock decompostion and the resulting mesh which can be generated by applying mapped meshing to the faces.

It remains to explain how to construct the medial axis. This is done by using a Delaunay technique (fig. 9a): The boundary δA of the domain A is approximated by a polygon p, and the constrained Delaunay triangulation (CDT) of p is computed. One gets an approximation to the medial axis by connection of the circumcircles of the Delaunay triangulation (the approximation is a subset of the Voronoi diagram of p).

By refining the discretization p of δA and applying this procedure one gets a series of approximations that converges to the medial axis (fig. 9b). Consider a triangle of the CDT to p: Part of it's circumcircle overlaps the complement of A. The overlap for the