ABSTRACT OF DISSERTATION

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POINT BASED APPROACHES IN GRAPHICS

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Many areas of computer graphics and vision utilize algorithms that are based on the concept of edges. Examples include polygon filling, clipping, projection, and shape reconstruction.

The areas studied in this dissertation, polygon filling and surface reconstruction, traditionally use edges to drive the algorithm. The algorithms presented in this work are controlled by points rather than edges.

The approach to polygon filling is to fill the area between two edges, but the creation of edges and transition between edges is determined by the points that are the vertices of the polygon. The vertices of the polygon are classified based on the action necessary when the vertex is encountered while filling the area bounded by the incident edge.

The approach to surface reconstruction from unorganized data uses feature point based edge segmentation. Feature points are points extracted from the data set that represent a feature of the surface. A point is labeled a feature point if there is sufficient variance among neighboring points to indicate that a surface transition occurs nearby. The surface is then segmented by edges.
connecting such feature points.

The vertex classification approach to polygon filling is shown to have significant speed advantages over classical algorithms such as scanline. Feature point based surface reconstruction is shown to produce comparable results to other techniques.

Additional areas investigated in this dissertation include parallel implementations of the algorithms, the filling of generalized polygons with curved edges, and the adaptation of the concept of Multi Scale Veto from 2D edge detection algorithms in computer vision to improve feature point detection with noisy data.