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Circular Arc Approximation Using Polygons

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Keywords**:** circular arc, approximation, polygon, generalization, GIS

Abstract

This article presents a method of approximating an arc using a polygon. The method uses the condition that the approximated arc describes equal surface areas of the circular sector. The method described in this article ensures that the polygons obtained by approximation have the same area as the original geometric.

1.Introduction

The approximation of geometric figures using constructing chords is a commonly known method. It is based on various criteria, e.g., minimizing the area of the part between the polygon and the circle [4], or others [1,8]. The criterion that the area of the approximation be equal to the area of the original geometric figure is also known [6]. This article concerns the approximation of a circle (Fig. 1). An arc is often a result of the approximation of other geometric figures, such as ellipses or curves [4,7]. It can be approximated in many ways [9].

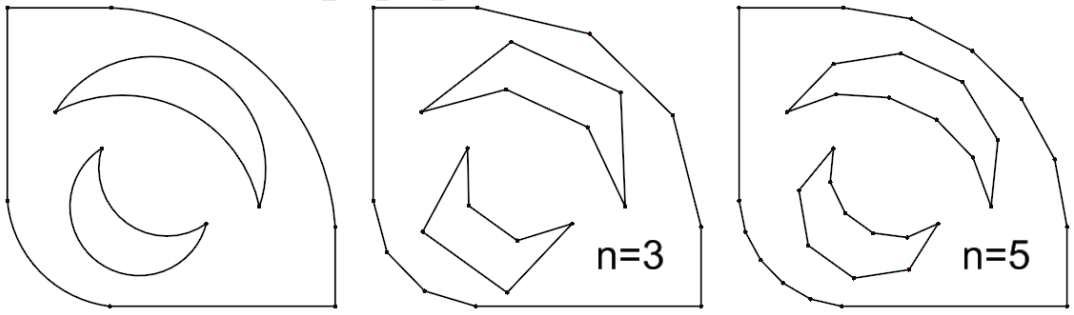

Fig. 1 Approximation of a figure constructed with line segments and arcs using a figure constructed only with line segments, preserving areas for the division of the arcs into n=3 and n=5 parts.

In GIS systems, the boundary lines of areas are most often composed of segments and arcs [3]. Unfortunately, most systems, e.g., cadastral ones, require boundaries to be represented using only segments [2]. This requirement stems from the need to represent the boundary of an area as a sequence of coordinates. Thus, arcs must be replaced with their linear approximations.

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