

Circular Arc Spline Approximation of Pointwise Curves for Use in NC Programing

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Introduction

The numerical control (NC) cutting machine:

- can cut only line segments and arcs
- arcs must have longer length for the better precision



The Inputs

- set of points in particular order
- points are in Cartesian plane
- Euclidean distance between points

The Problem

From a set of points (inputs) we must create a sequence of segment lines and arcs:

- passing through some of the points and being "sufficiently close" to the others - error condition
- we are interested in the non trivial case when the segments of points can not be approximated by a straight line
- the company wants to find arcs that are as **long** as possible

The Best Arc

The best arc between two fixed points:

- has a center and a radius
- has an initial and a final point through which it passes
- passes through at least 3 points
- the arc is **better** if it has **longer** length (that means the points between the first and the final point of the arc are as many as possible)
- the inner points are as close as possible to the arc (smallest Euclidean distance)

What we have done

- a program for finding the center and the radius of a circle passing through three points
- a program for finding the best arc between two fixed points
- a program for finding the best arcs between any two fixed points (that have at least two inner points)
- a program that excludes those arcs that don't satisfy the **error condition**
- adapted an algorithm for finding the best path (with smallest amount of nodes) in the graph

The Algorithm

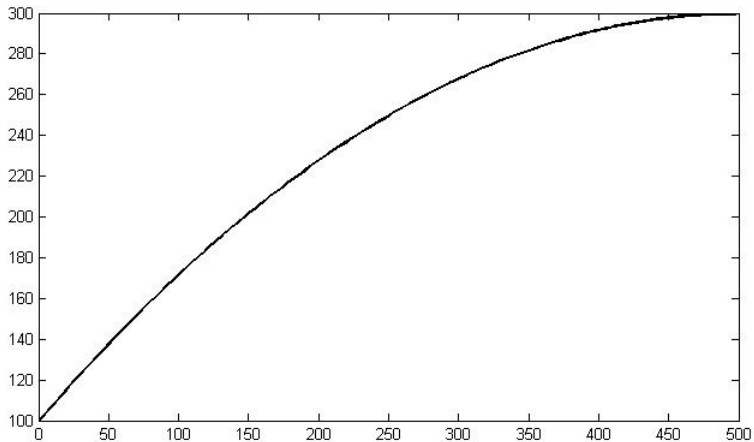
We compare the paths by the length of their shortest arc. The best path is the one that is contained of arcs and the shortest arc is as long as possible. From the graph theory we have adapted an algorithm for our particular task. We have chosen an algorithm for finding the best path with smallest amount of nodes.

What we have done

- a test with a real set of points that the company gave
- the company was pleased with the the solution we received
- we have improved the algorithm and have applied it
- we have tried another approach

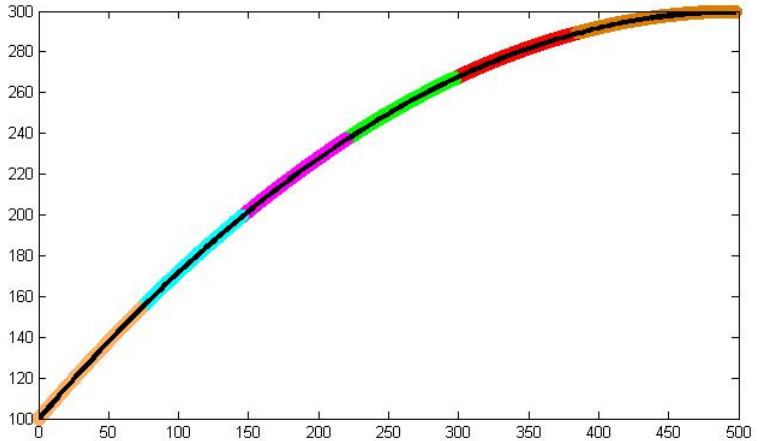
The Results

Graphics for the Solution of a Certain Example

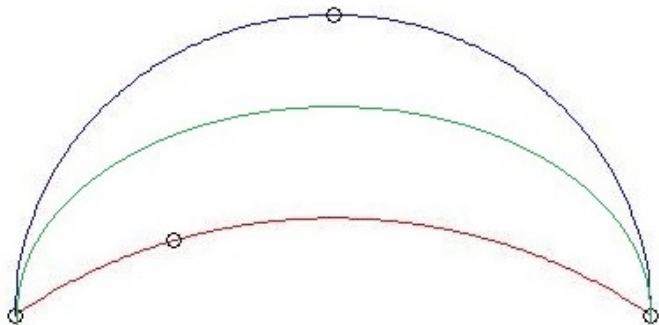


The Results

Graphics for the Solution of Certain Example

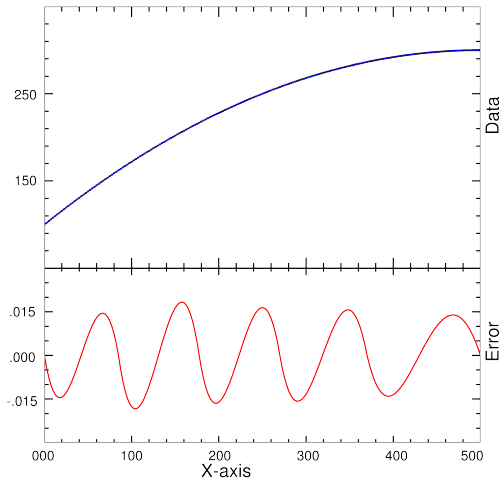


Improving the Algorithm



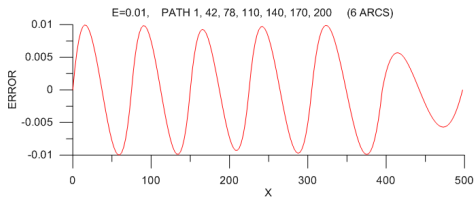
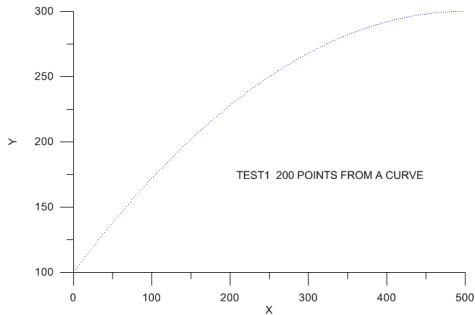
The Results

Graphics for the Solution by Third Algorithm



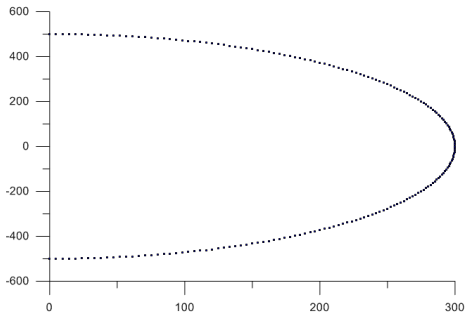
Results

Graphics for the Solution by Improved Algorithm

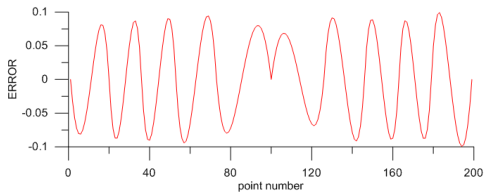


Results

Graphics for the Solution by Improved Algorithm

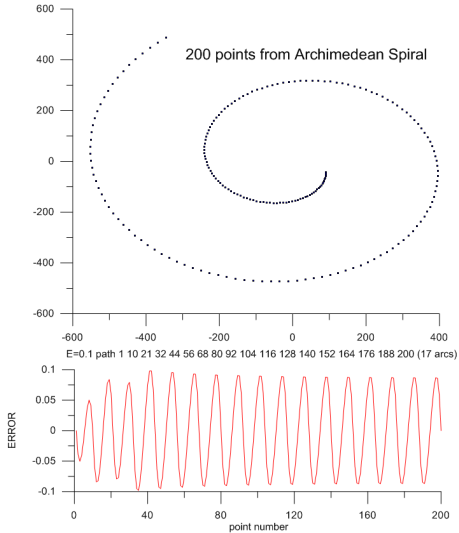


$E=0.1$ 10 arcs



Results

Graphics for the Solution by Improved Algorithm



Thank you for your attention!!!