# Scientific Computing Lab - Mid sem

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**Abstract**

Drawing a spiral by parametric spline functions
Interpolating our signature with a computer plotter using cubic splines.

## 1 Spiral interpolation

### 1.1 Gathering the sample points

Firstly, for interpolation we need some sample set of points on which the it is developed. These are generated by the using some third party softwares like 'G3Graph Data Analyzer' or 'windig'.

Here, I have used G3 and obtained a set of sufficient sample points of the spiral. You just need to open the image(Figure 1) and set the origin and scale. Now you can obtain all the points you need on that reference frame. I have used the image which was given in the assignment paper for taking sample points

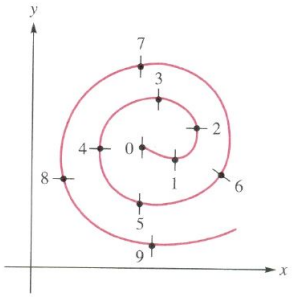



Figure 1: Image of spiral used for taking points

### 1.2 Using the algorithm

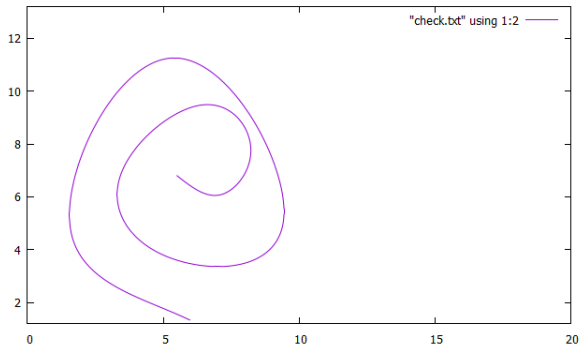
Now that we have all the points to give as input we proceed in writing the algorithm for the spline interpolation. The code has been written and properly for understanding of what we are doing and is included in the folder. Here, we have solved a tridiagonal linear system by using an algorithm which was given in the lecture slides.

## 1.3 Code

The code is written in .cpp format and hard copy is handed over in the lab session. The points which are stored in spiral 10.txt and spiral 30.txt are given as input after giving the number of points which are used for interpolation. The output of this execution is redirected to a file check.txt where the full set of points are stored for plotting. Using 'gnuplot' plot the contents of a text file using command 'plot "check.txt" using 1:2 with lines'.
The obtained plots are shown below.

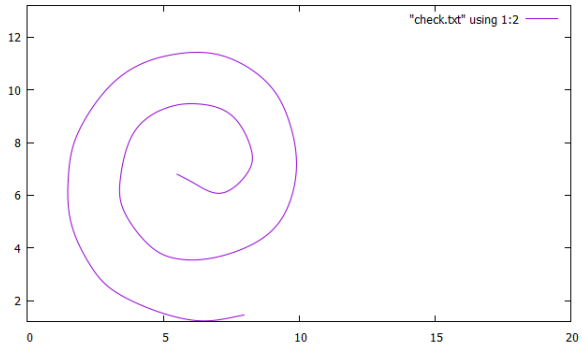
## 1.4 Result and Inferences

Figure 2: Spiral with 10 sample points




Here you can see that if we take a limited (or low) set of points as in 'Figure 2' you can see that there is dicrepency from the actual image. It is because that even though the curvature of the spiral is smooth,if the points are at a resonable distance, the splines may not be the exact function by which it is drawn. The functional values obtained from spline funtions are just approximations or predictions.

Figure 3: Spiral with 30 sample points




As we keep on increasing the number of sample points the interpolating spiral tends to become the actual image from which points are generated.

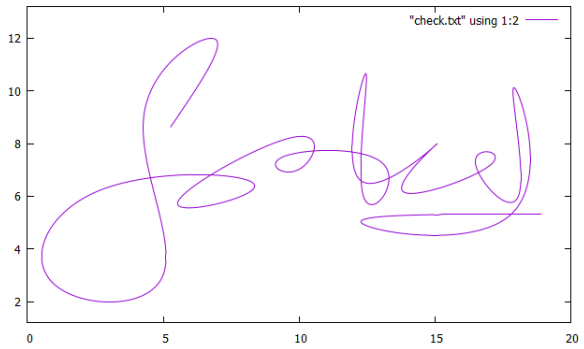
# 2 Signature interpolation

## 2.1 Gathering the sample points

For this part of the question we were constrained to use knots close to 20 only. So by intuition I have selected the points which would help in building the signature and neglected the points which might not affect the curvature much. All together I have got 24 points which will be good enough for interpolation. These are points taken using the previous software 'G3' are stored in the file named 'Sign points 24.txt'.
We have used the similar algorithm and code for interpolating the signature but just with a change in the number of points and points given as input. The same method as previous time if followed of giving input the points and setting the output to a different file, the plotting the output using gnuplot.

## 2.2 Result and Inferences

Figure 4: Signature with 24 sample points




Here you can observe that this interpolated curve is close to the actual signature but is not exact. It is varying at some points as it is very difficult to interpolate a graph with lot of curves. You need to choose the right set of sample points, only then you could obtain a better approximation of the actual graph.

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