SCIENTIFIC COMPUTING

MID-SEM ASSIGNMENT

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DATE – 04/10/2015

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ALGORITHM

- In the cubic spline method, the function is constructed using –

$S_j = a_j + b_j (x-x_j) + c_j(x- x_j)^2 + d_j (x- x_j)^3$, given the values of a's, we find the values of b, c, d for different intervals along the entire curve of the function.

- In the assignement , we use Parametric Cubic Spline.
- We read the x and y coordinates from an excel file which are actually the points that are extracted from the image. We run a paramter t for the given n points and plot x vs t and y vs t.

t	0	1	...	n
x	x_0	x_1	...	x_n
y	y_0	y_1	...	y_n

- That means, we construct a cublic spline both for x coordinates and y coordinates. Let the cubic spline for x coordinates be X(t) and Y(t) for y coordinates.That is, we have actually generate the values of bx,cx,dx and by,cy and dy.
- Now in order to know the value of X(t) and Y(t), we divide each interval of t into 10 equal parts and calculate the X(t) and Y(t) in the following way as seen in the code :

```
x[i]= (dx[temp]*pow(tp,3))+ (cx[temp]*pow(tp,2))+ (bx[temp]*pow(tp,1))+ x[temp];

y[i]= (dy[temp]*pow(tp,3))+ (cy[temp]*pow(tp,2))+ (by[temp]*pow(tp,1))+ y[temp];
```

temp represents the index of the different intervals.

tp represents t-t[i], where t[i-1]<=t<=t[i].

- Example : If we have 20 points , then we have 19 intervals.We divide each interval into 10 parts in order to plot the curve.
- Now each interval of the paramater has unique values of a, b, c and d. Now, x-x[j] here is equivalent to t-t[j] both for X(t) and Y(t) where, t[i-1] <=t<=t[i].
- Therefore, in this we have a plot of X(t) and Y(t). Now, these values of X(t) and Y(t) actually plot the function.

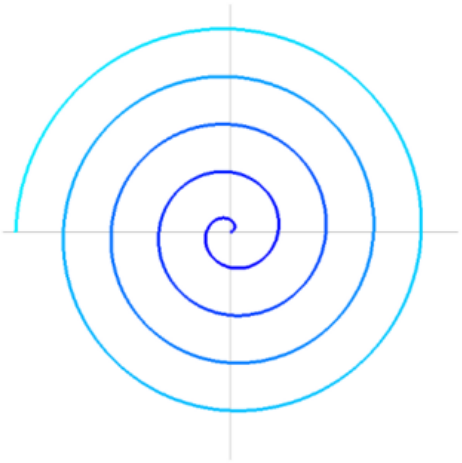
QUESTION -01

OBJECTIVE-

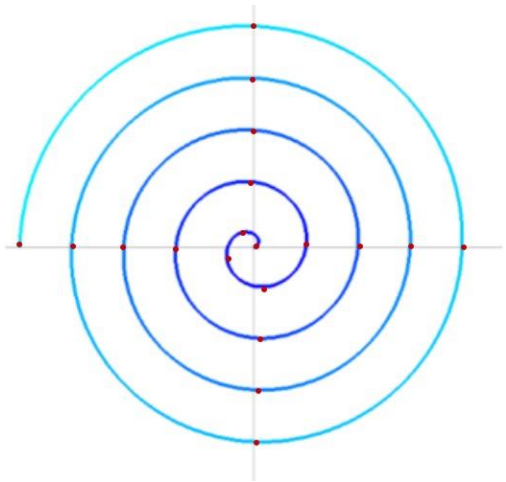
- To draw a spiral and reproduce it using parametric spline functions

POINTS EXTRACTION

- Image extracted using – WebPlotDigitizer
- Image before extraction of points



- Image after extraction of points. The red points indicate the points selected

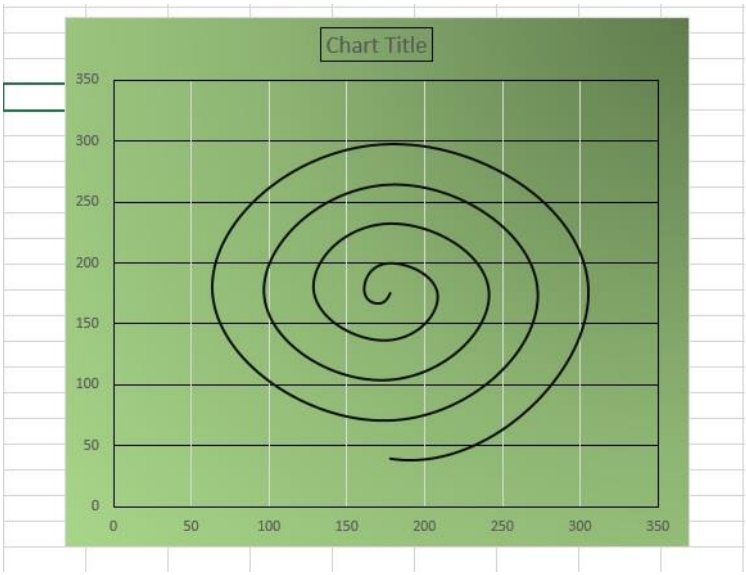


QUESTION -01

- Total points extracted =19

PLOTTING THE IMAGE USING CUBIC SPLINE

- Image after running the Cubic Spline algorithm for the spiral curve given



- Image plotted using Microsoft Excel

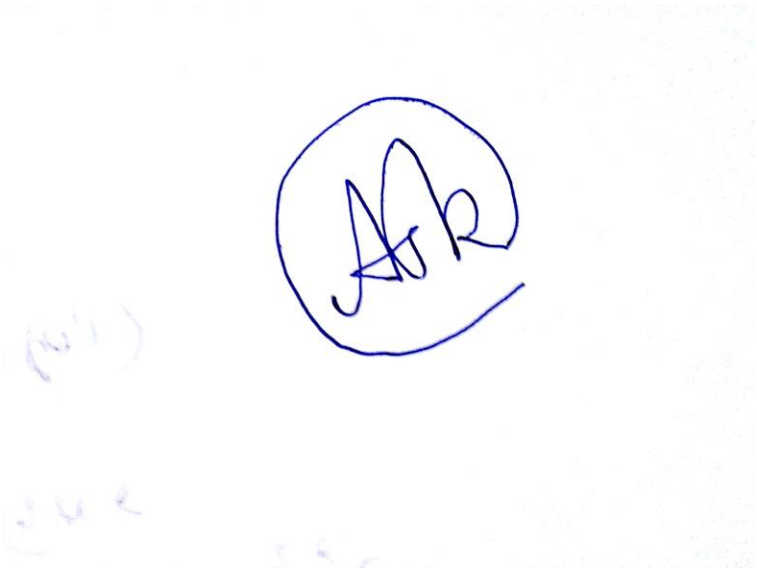
QUESTION 02

OBJECTIVE-

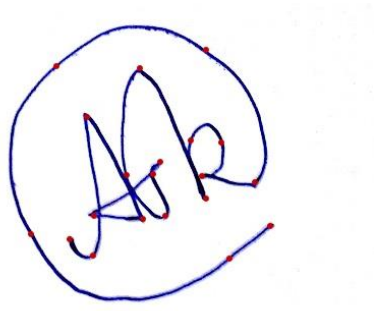
- To plot our own signature using maximum 20 knots and cubic spline

POINTS EXTRACTION

- Points extracted using WebPlotDigitizer
- Image before extraction



- Image after extracting the points. The red points indicate the points selected

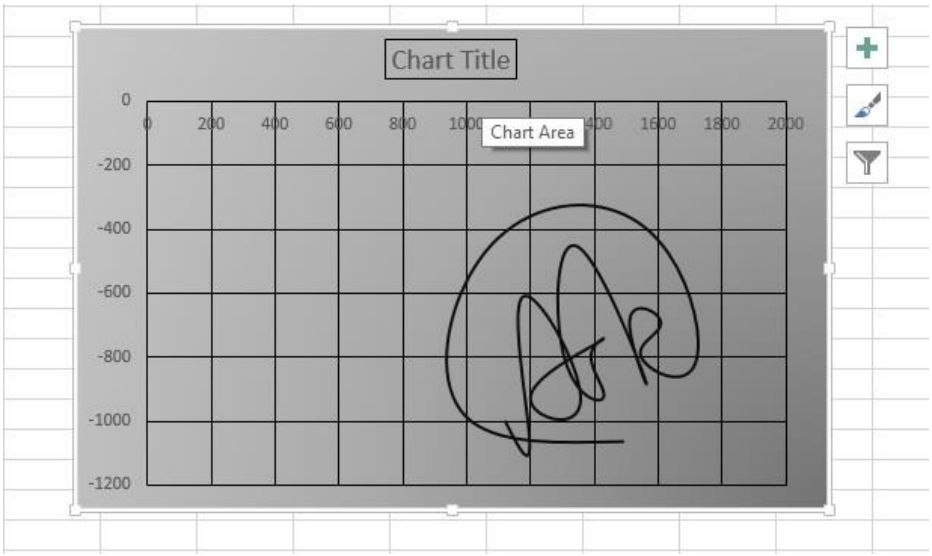


- Total points extracted - 20

QUESTION 02

PLOTTING THE IMAGE USING CUBIC SPLINE

- Image after running the Cubic Spline algorithm for the spiral curve given

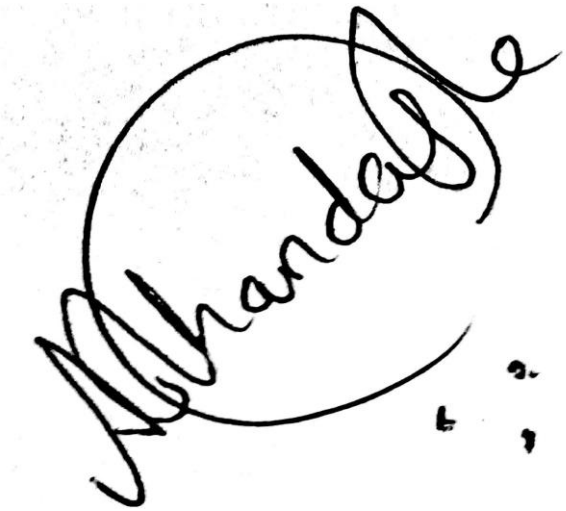


- Image plotted using Microsoft Excel.

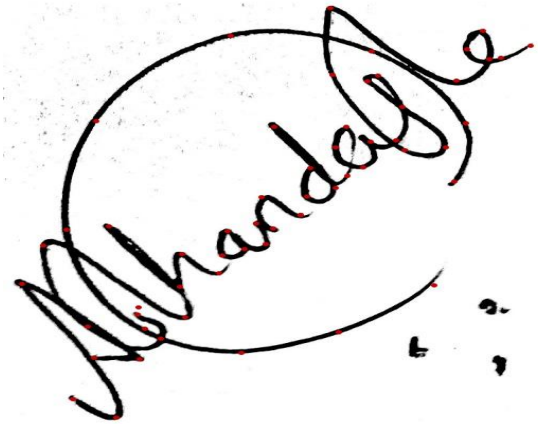
QUESTION 02

Signature 2 (more than 20 points)

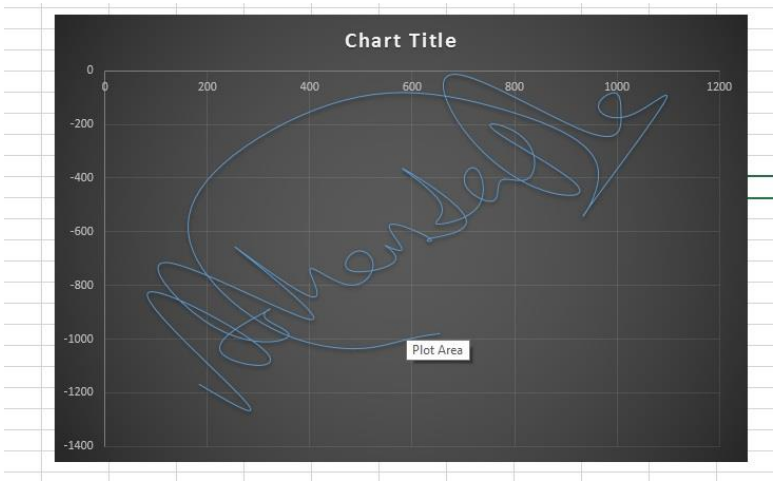
- Original Image



- Image after extracting the points



QUESTION 02



- Image after plotting

CONCLUSION

- The parametric spline equation were successfully found out and also the image was plotted
- The plot requires more number of initial points for curves having a lot of curvatures.
- Cubic lines prove to be the best for continous curves.