

**Topic** : Additional Interpolation Topics

**Simulation** : Comparing Polynomial Interpolation and Spline Interpolation

**Language** : Matlab r12

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**Abstract** : A rapid robot arm with a laser is used to make seven holes on a rectangular plate 12" X 8" at six points as shown. The path of the robot going from one indentation point to another needs to be smooth so as to avoid sharp jerks in the arm that can otherwise create premature wear and tear of the robot arm. One suggestion has been to fit a fifth order polynomial through the six points. Another suggestion was to fit a quadratic spline through the holes. Which suggestion is better so that the robot path is shorter but also smooth?

```
clear all
```

```
% INPUT: The following is the data (x-y) coordinate data of the center of the six holes.
```

```
x=[2 4.5 5.25 7.81 9.2 10.6];
```

```
y=[7.2 7.1 6.5 3.5 5];
```

```
% SOLUTION:
```

```
% This calculates window size to be used in figures
```

```
set(0,'Units','pixels')
```

```
scnsize = get(0,'ScreenSize');
```

```
wid = round(scnsize(3));
```

```
hei = round(0.95*scnsize(4));
```

```
wind = [1, 1, wid, hei];
```

```
%%%%%%%%% Polynomial interpolation %%%%%%%%%%
```

```
figure('Position',wind)
```

```
p=polyfit(x,y,numel(x)-1);
```

```
x1=2:0.01:10.6;
```

```
y1=polyval(p,x1);
```

```
plot(x1,y1,'b','LineWidth',3)
```

```
% Approximates length of curve
```

```
Ll=0;
```

```
for i=2:numel(x1)
```

```
    Ll=Ll+((x1(i)-x1(i-1))^2+(y1(i)-y1(i-1))^2)^0.5;
```

```
end
```

```
hold on
```

```
plot(x,y,'ro','MarkerSize',8,'MarkerFaceColor',[1,0,0])
```

```
title('Path of robot arm using polynomial interpolation','Fontweight','bold','FontSize',14)
```

```
text(4,4,['Length of curve = ',num2str(Ll)])
```

```
xlim([1 11])
```

```

ylim([0 10])

%%%%%% Spline interpolation %%%%%%
figure('Position',wind)
xx=2:0.01:10.6;
yy=spline(x,y,xx);
plot(xx,yy,'g','LineWidth',3)

% Approximates length of curve
Ls=0;
for i=2:numel(xx)
    Ls=Ls+((xx(i)-xx(i-1))^2+(yy(i)-yy(i-1))^2)^0.5;
end

hold on
plot(x,y,'ro','MarkerSize',8,'MarkerFaceColor',[1,0,0])
title('Path of robot arm using cubic spline interpolation','Fontweight','bold','FontSize',14)
text(4,4,['Length of curve = ',num2str(Ls)])
xlim([1 11])
ylim([0 10])

% Both imposed on each other
figure('Position',wind)
hold on
plot(x1,y1,'b','LineWidth',3)
plot(xx,yy,'g','LineWidth',3)
plot(x,y,'ro','MarkerSize',8,'MarkerFaceColor',[1,0,0])
title('Path of robot arm compared using polynomial interpolation and cubic spline
interpolation','Fontweight','bold','FontSize',14)
xlim([1 11])
ylim([0 10])

```



