03.03.2016

Geometrie Computationala – Laborator 3

1) Fie polinomul P = 16*t^2-12*t+2 , t in [0,1]

a) Sa se reprezinte P(t) in baza Bernstein {b^{3}_{k}(t)} k=0,3

```
clear all;
syms t a0 a1 a2 a3 reals;
P = 16*t^2-12*t+2;
b0 = (1-t)^3;
b1 = 3*t*(1-t)*(1-t);
b2 = 3*t*t*(1-t);
b3 = t^3;
x = simplify(P - a0*b0 - a1*b1 - a2*b2 - a3*b3);
x0 = subs(x,t,0)
x1 = subs(diff(x,t),t,0)
x2 = subs(diff(x,t,2),t,0)/2
x3 = diff(x,t,3)/6
y = coeffs(x,t)
r = solve(x0, x1, x2, x3, a0, a1, a2, a3)
y0 = r.a0
y1 = r.a1
y2 = r.a2
y3 = r.a3
```

(rezultate)

x = 16*t^2 - a3*t^3 - 12*t + a0*(t - 1)^3 - 3*a1*t*(t - 1)^2 + 3*a2*t^2*(t - 1) + 2

x0 =2 - a0

x1 =3*a0 - 3*a1 - 12

x2 =6*a1 - 3*a0 - 3*a2 + 16

x3 =a0 - 3*a1 + 3*a2 - a3

y =[2 - a0, 3*a0 - 3*a1 - 12, 6*a1 - 3*a0 - 3*a2 + 16, a0 - 3*a1 + 3*a2 - a3]

y0 =2

y1 =-2

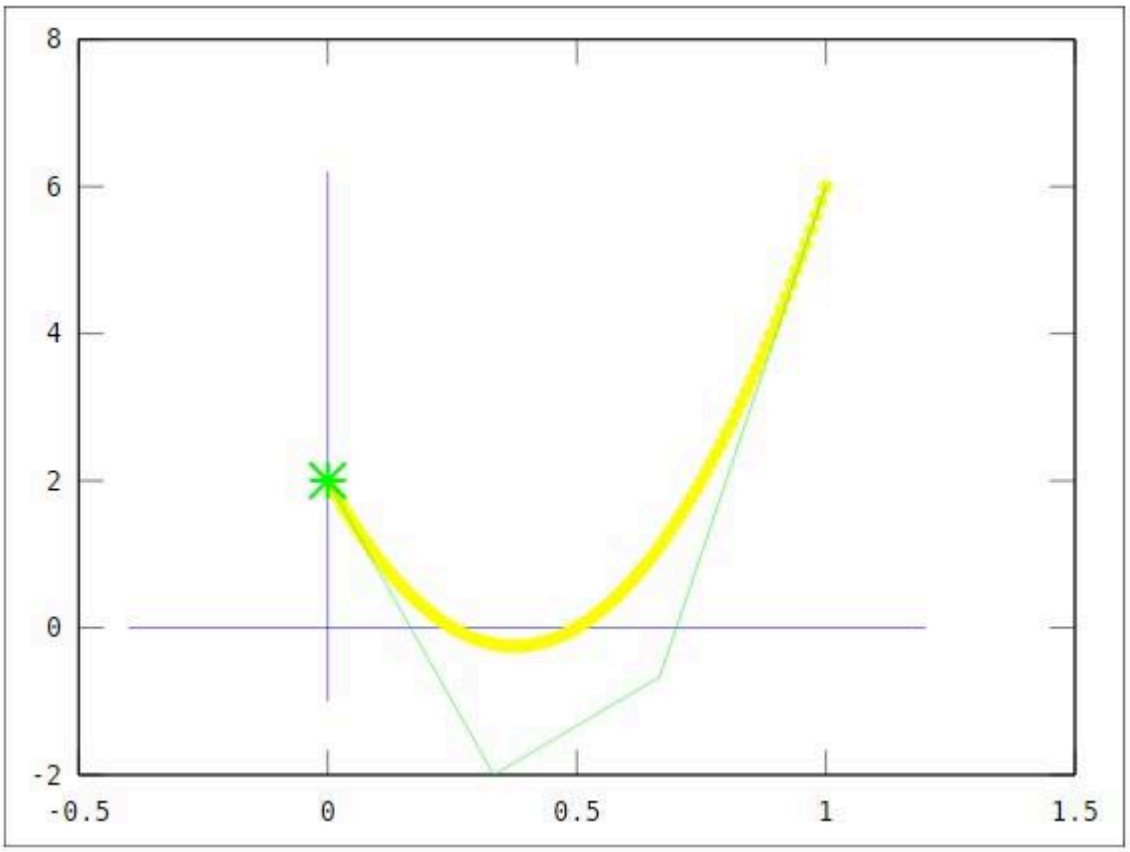
y2 =-2/3

y3 =6

b) Sa se reprezinte grafic functia polinomiala P(t)

```
clear all;
h = 0.01;
t=0:h:1;
P=16*t.^2-12*t+2;
plot(t,P,'r')
hold on
plot([-0.4 1.2],[0 0])
hold on
plot([0 0],[-1 6.2])
hold on
x0=0;
x1=1/3;
x2=2/3;
```

```
x3=1;
y0=2;
y1=-2
y2=-2/3;
y3=6;
b0=(1-t).^3;
b1=3*t.*(1-t).*(1-t);
b2=3*t.*t.*(1-t);
b3=t.^3;
x = x0*b0 + x1*b1 + x2*b2 +x3*b3;
y = y0*b0 + y1*b1 + y2*b2 +y3*b3;
plot(x,y,'.y')
hold on
plot([x0 x1 x2 x3],[y0 y1 y2 y3],'g')
hold on
plot(x0,y0,'*g')
```



c) Sa se gaseasca un poligon de control P0, P1, P2, P3 astfel incat cubica Bezier corespunzatoare sa fie graficul de mai sus

```
clear all;

syms t a0 a1 a2 a3 reals;

P = t;

b0 = (1-t)^3;

b1 = 3*t*(1-t)*(1-t);

b2 = 3*t*t*(1-t);

b3 = t*t*t;

x = simplify(P - a0*b0 - a1*b1 - a2*b2 - a3*b3);
```

```
x0 = subs(x,t,0)

x1 = subs(diff(x,t),t,0)

x2 = subs(diff(x,t,2),t,0)/2

x3 = diff(x,t,3)/6

y = coeffs(x,t)

r = solve(x0, x1, x2, x3, a0, a1, a2, a3)

y0 = r.a0

y1 = r.a1

y2 = r.a2

y3 = r.a3
```

(rezultate)

```
x = t - a3*t^3 + a0*(t - 1)^3 - 3*a1*t*(t - 1)^2 + 3*a2*t^2*(t - 1)

x0 =-a0

x1 =3*a0 - 3*a1 + 1

x2 =6*a1 - 3*a0 - 3*a2

x3 =a0 - 3*a1 + 3*a2 - a3

y = [ -a0, 3*a0 - 3*a1 + 1, 6*a1 - 3*a0 - 3*a2, a0 - 3*a1 + 3*a2 - a3]

y0 =0

y1 =1/3

y2 =2/3

y3 =1
```

Ex 2) Se considera 4 poligoane de control P0P1P2P3, P0P1'P2P3, P0P1P2'P3 si P0P1'P2'P3, precum si cubicele Bezier corespunzatoare. Sa se deseneze cele "4 perechi" (poligon + curba) in 4 subferestre Matlab (folosind subplot) si sa se compare.

P1' (a, 3*a) ; P2'(5-b, 2*b-1)

In cazul a=4.

```
clear all;

x0=0;

x1=1;

x2=4;

x3=5;

x1p=4;

x2p=1;

y0=0;

y1=3;

y2=1;

y3=-1;

y1p=12;

y2p=7;

t=0:0.01:1;

b0=(1-t).^3;

b1=3*t.*(1-t).*(1-t);

b2=3*t.*t.*(1-t);

b3=t.^3;

subplot(2,2,1)

x = x0*b0 + x1*b1 + x2*b2 +x3*b3;
```

```
y = y0*b0 + y1*b1 + y2*b2 +y3*b3;
plot(x,y,'.r')
hold on
plot([x0 x1 x2 x3],[y0 y1 y2 y3],'g')
hold on
ylim([-1,18])
subplot(2,2,2)
plot(x0,y0,'*g')
x = x0*b0 + x1p*b1 + x2*b2 +x3*b3;
y = y0*b0 + y1p*b1 + y2*b2 +y3*b3;
plot(x,y,'.r')
hold on
plot([x0 x1p x2 x3],[y0 y1p y2 y3],'g')
hold on
plot(x0,y0,'*g')
ylim([-1,18])
subplot(2,2,3)
x = x0*b0 + x1*b1 + x2p*b2 +x3*b3;
y = y0*b0 + y1*b1 + y2p*b2 +y3*b3;
plot(x,y,'.r')
hold on
plot([x0 x1 x2p x3],[y0 y1 y2p y3],'g')
hold on
plot(x0,y0,'*g')
ylim([-1,18])
subplot(2,2,4)
```

```
x = x0*b0 + x1p*b1 + x2p*b2 +x3*b3;
y = y0*b0 + y1p*b1 + y2p*b2 +y3*b3;
plot(x,y,'.r')
hold on
plot([x0 x1p x2p x3],[y0 y1p y2p y3],'g')
hold on
plot(x0,y0,'*g')
ylim([-1,18])
```