Digitalni multimedij

Bezierova krivulja - osvrt

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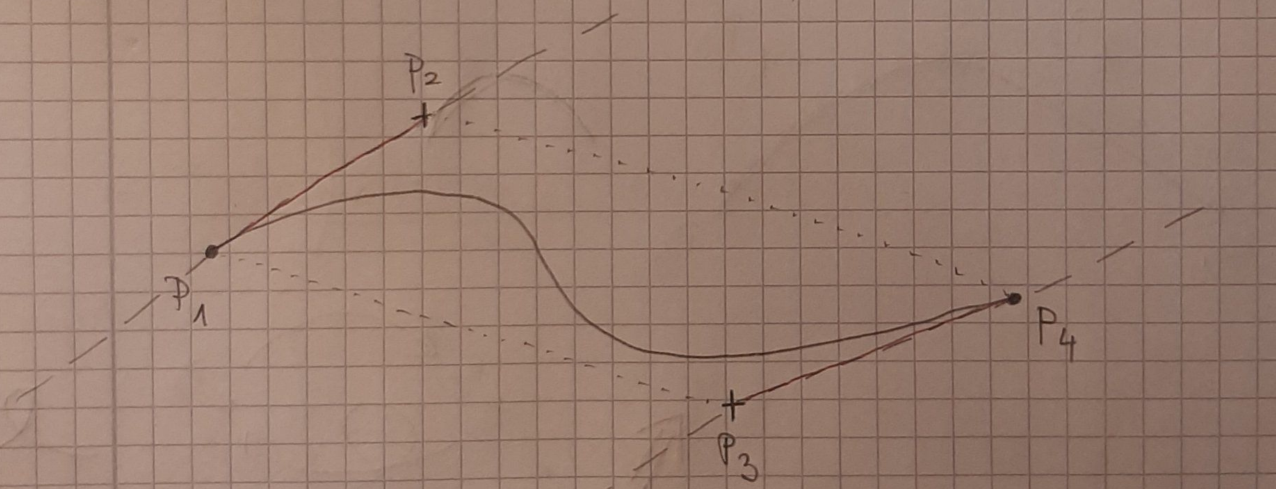
↳ glavna krivulja današnje vektorske grafike

• karakteristika: na temelju 4 točke možemo unaprijed predvidjeti rasprostiranje krivulje



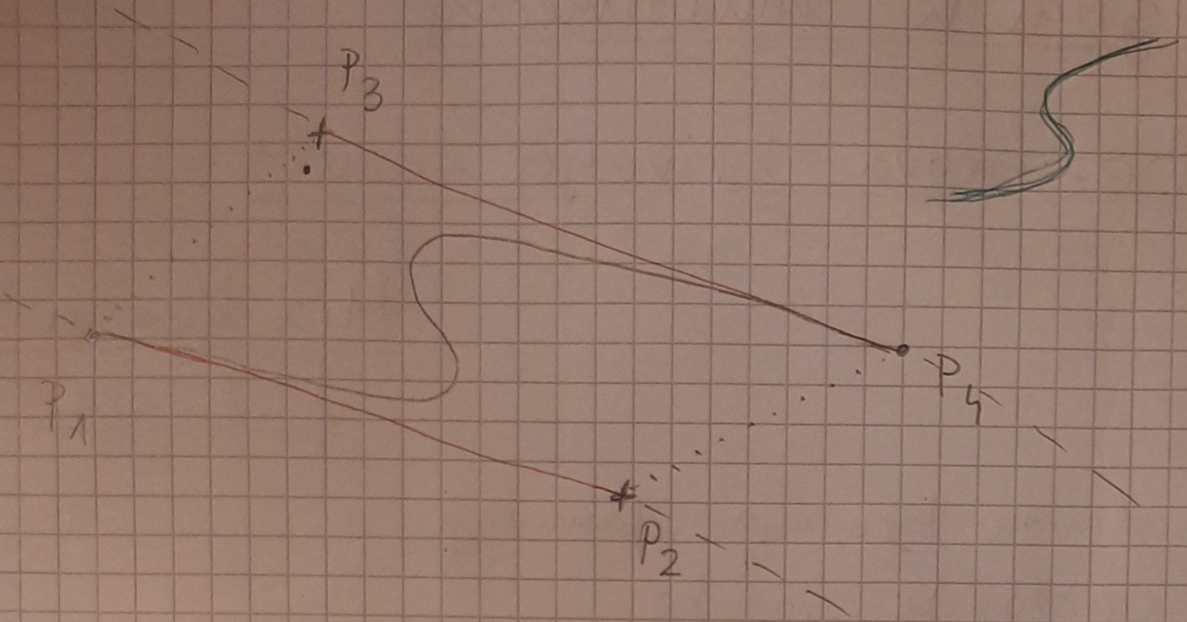
$\overline{P_1 P_2}$

$\overline{P_3 P_4}$

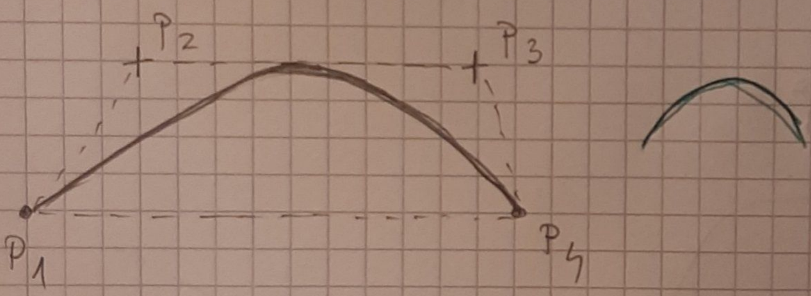
↳ tijelo krivulje se uvijek rasprostire unutar poligona

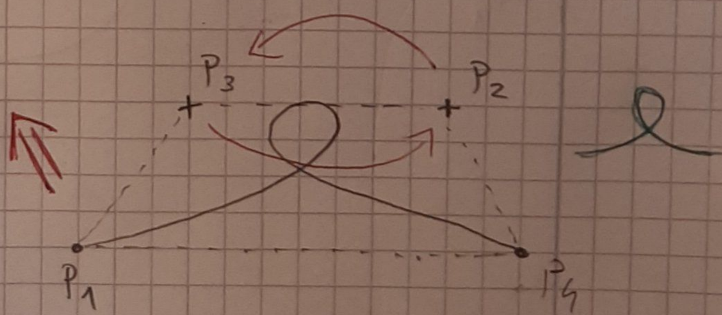
↳ $\overline{P_1 P_2}$ čine tangentu na P_1

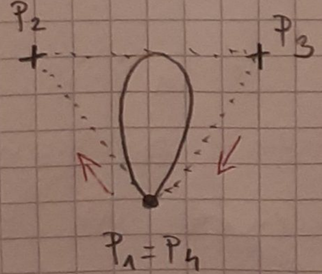
↳ $\overline{P_3 P_4}$ čine tangentu na P_4

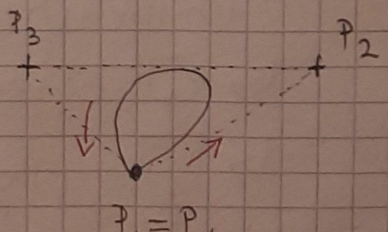


• Bezier krivulja pripada porodici PREDVIDLJIVIH KRIVULJA

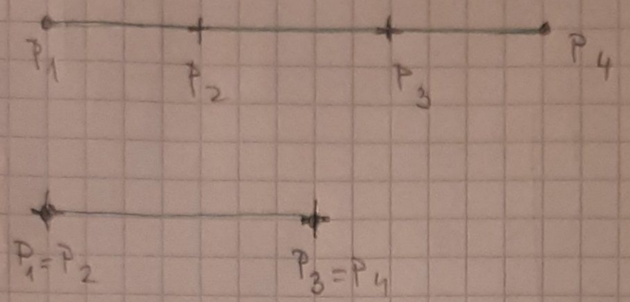




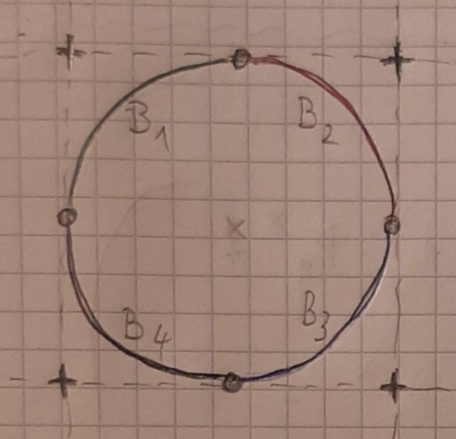




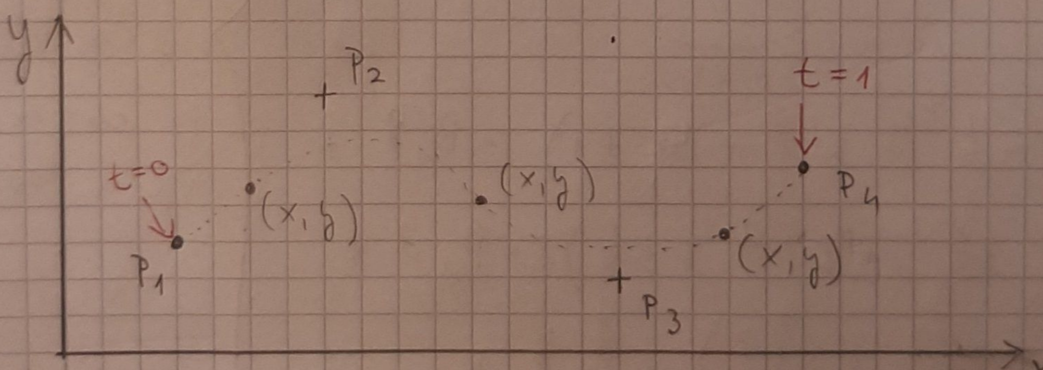
• DUŽINE:



• KRUŽNICA:



* Matematički Uvod:



$P_1(P_1^x, P_1^y)$

$P_2(P_2^x, P_2^y)$

$P_3(P_3^x, P_3^y)$

$P_4(P_4^x, P_4^y)$

- b. krivulja je definirana sa 8 brojeva
- b. krivulja je PARAMETARSKA krivulja 3. stupnja
- $C(t) \Rightarrow$ krivulja u parametru $t \Rightarrow$

$$C(t) = \begin{bmatrix} t^3 & t^2 & t & 1 \end{bmatrix} \times B \times \begin{bmatrix} P_1 \\ P_2 \\ P_3 \\ P_4 \end{bmatrix}$$

MAT. DEF. BEZIER KRIVULJE

$$B = \begin{bmatrix} -1 & 3 & -3 & 1 \\ 3 & -6 & 3 & 0 \\ -3 & 3 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \begin{array}{l} \Sigma = 0 \\ \Sigma = 0 \\ \Sigma = 0 \\ \Sigma = 1 \end{array}$$

$$\Sigma = 0 \quad \Sigma = 0 \quad \Sigma = 0 \quad \Sigma = 1$$

$$\left.\begin{aligned} x(t) = {} & (-t^3 + 3t^2 - 3t + 1) \cdot P_1^x + \\ & + (3t^3 - 6t^2 + 3t) \cdot P_2^x + \\ & + (-3t^3 + 3t^2) \cdot P_3^x + \\ & + (t^3) \cdot P_4^x \\ \\ y(t) = {} & (-t^3 + 3t^2 - 3t + 1) \cdot P_1^y + \\ & + (3t^3 - 6t^2 + 3t) \cdot P_2^y + \\ & + (-3t^3 + 3t^2) \cdot P_3^y + \\ & + (t^3) \cdot P_4^y \end{aligned}\right\}$$

- ovaj par jednadžbi stvara sve točke (x, y) b. krivulje i crta cijelu krivulju

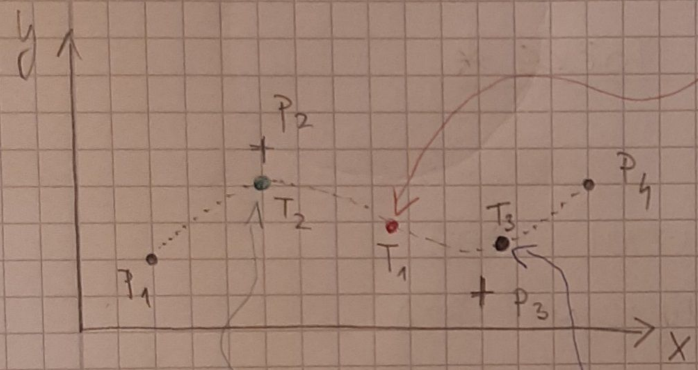
npr. $\underline{t = 0}$

$$\left.\begin{aligned} x(0) &= P_1^x \\ y(0) &= P_1^y \end{aligned}\right\} P_1$$

za $\underline{t=1}$: $\left.\begin{aligned} x(1) &= P_4{}^x \\ y(1) &= P_4{}^y \end{aligned}\right\}$ P_4

⇒ Sve točke koje čine krivulju se crtaju s parametrima t koji moraju biti između 0 i 1 !

$t \in [0,1]$



npr. $t = 0,5$

⇓

$\left.\begin{aligned} x(0,5) \\ y(0,5) \end{aligned}\right\} T_1$

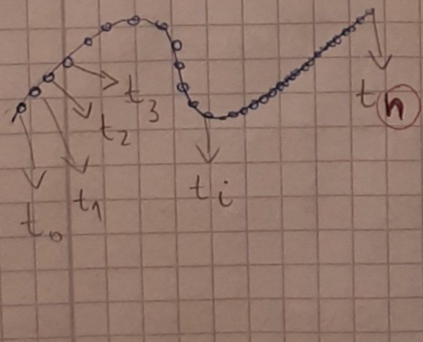
npr. $t = 0,25$

$\left.\begin{aligned} x(0,25) \\ y(0,25) \end{aligned}\right\} T_2$

npr. $t = 0,75$

$\left.\begin{aligned} x(0,75) \\ y(0,75) \end{aligned}\right\} T_3$

⇒ Koliko t-ova treba?



⇒ Crta sastavljena od jako puno točkica (na ekranu)

⇒ Koja gustoća (rezolucija) mora biti?

$\Delta t = 0,1 \Big\} \; t \in [0,1] \Rightarrow \left.\begin{aligned} t_0 &= 0 \\ t_1 &= t_0 + \Delta t = 0,1 \\ t_{10} &= 1,0 \end{aligned}\right\}$ za $\Delta t = 0,1$ $n = 11$

⇒ ako je $\Delta t = 0{,}01$

↳ $n = 101$

⇒ ako je $\Delta t = 0{,}001$

↳ $n = 1001$

$$n = \frac{1}{\Delta t} + 1$$ ⇒ BROJ TOČAKA KOJE ČINE KRIVULJU

⇒ Sa Δt se definira gustoća točaka u krivulji

* SPOJNE BEZIER TOČKE *

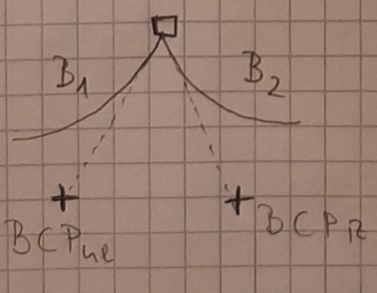
↳ koriste ih softveri

↳ tri su vrste: 1°) KUTNI SPOJ

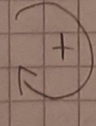
2°) KRIVULJNI SPOJ

3°) TANGENTNI SPOJ

⇒ <u>KUTNI SPOJ</u>: - označava se sa □



- ovisi o orijentaciji krivulje



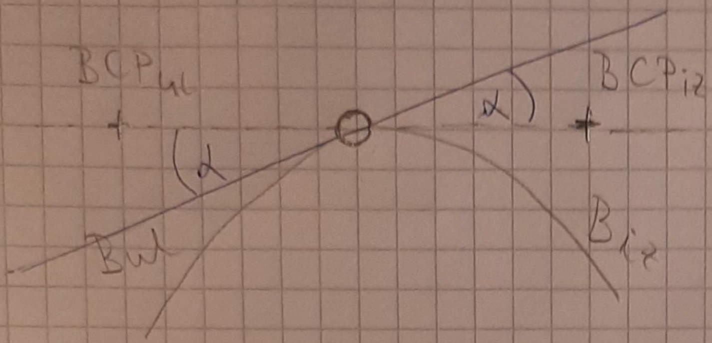
$B_1 = B_{ulazni}$

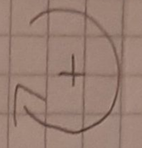
$B_2 = B_{izlazni}$

- BCP_{ul} : bezier control point ulazni
- BCP_{iz} : bezier control point izlazni

- $BCP_{ul} \neq BCP_{iz}$

⇒ KRIVULJNI SPOJ: – označava se sa O





– $BCP_{ul} = f$ pravca
(BCP_ul, spojna točka)

⇒ TANGENTNI SPOJ: – označava se sa Δ
– služi za idealni zavoj
– onemogućavaju titranje