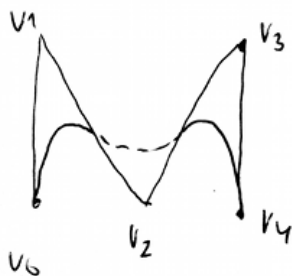


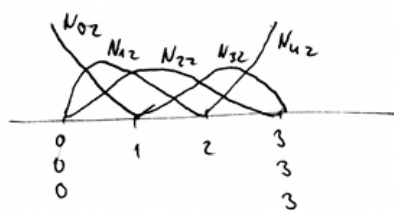
Dané sú body  $V_0(0,0)$ ,  $V_1(0,1)$ ,  $V_2(1,0)$ ,  $V_3(2,1)$ ,  $V_4(2,0)$  a ich váhy  $(1,1, w_2, 1, 1)$ . Použite vhodný vzťahový vektor pre NURBS-křivky 2° napíšte parametrické vyjadrenie pre jednotlivé segmenty a potom pre váhy  $w_2 = 0; 0.5; 1; 5$ . Graficky ilustrujte (jednotku na dvoch osiach zvoľte väčšiu).

Riešenie:  $D(u) = V_0 R_{02}(u) + V_1 R_{12}(u) + V_2 R_{22}(u) + V_3 R_{32}(u) + V_4 R_{42}(u)$

① vzťahový vektor  $p=2$ ;  $U = \{u_0, \dots, u_m\}$   $m = n + p + 1$   
 $m = 4 + 2 + 1 = 7$



$\{u_0, \dots, u_7\}$   
 vhodný:  $\{0, 0, 0, 1, 2, 3, 3, 3\}$



② počet segmentov: 3

③ celistvé B-spl. funkcie (príklad 13, B-splajny)

$$N_{02}(u) = (1-u)^2 \quad u \in \langle 0, 1 \rangle$$

$$N_{12}(u) = \begin{cases} \frac{1}{2}u(4-3u) & u \in \langle 0, 1 \rangle \\ \frac{1}{2}(2-u)^2 & u \in \langle 1, 2 \rangle \end{cases}$$

$$N_{22}(u) = \begin{cases} \frac{1}{2}u^2 & u \in \langle 0, 1 \rangle \\ \frac{1}{2}(-2u^2 + 6u - 3) & u \in \langle 1, 2 \rangle \\ \frac{1}{2}(3-u)^2 & u \in \langle 2, 3 \rangle \end{cases}$$

$$N_{32}(u) = \begin{cases} \frac{1}{2}(u-1)^2 & u \in \langle 1, 2 \rangle \\ \frac{1}{2}(-3u^2 + 14u - 15) & u \in \langle 2, 3 \rangle \end{cases}$$

$$N_{42}(u) = (u-2)^2 \quad u \in \langle 2, 3 \rangle$$

④ Njčidime racionalne funkcije, pre naky  $(1, 1, w_2, 1, 1)$

$$R_{02}(u) = \frac{w_0 N_{02}(u)}{\sum_{i=0}^4 w_i N_{i2}(u)} = \frac{(1-u)^2}{(1-u)^2 + u(4-3u)/2 + w_2 u^2/2} \quad u \in (0, 1)$$

$$R_{12}(u) = \frac{w_1 N_{12}(u)}{\sum_{i=0}^4 w_i N_{i2}(u)} = \begin{cases} \frac{u(4-3u)/2}{(1-u)^2 + u(4-3u)/2 + w_2 u^2/2} & u \in (0, 1) \\ \frac{(2-u)^2/2}{(2-u)^2/2 + w_2(-2u^2+6u-3)/2 + (u-1)^2/2} & u \in (1, 2) \end{cases}$$

$$R_{22}(u) = \frac{w_2 N_{22}(u)}{\sum_{i=0}^4 w_i N_{i2}(u)} = \begin{cases} \frac{w_2 u^2/2}{(1-u)^2 + u(4-3u)/2 + w_2 u^2/2} & u \in (0, 1) \\ \frac{w_2(-2u^2+6u-3)/2}{(2-u)^2/2 + w_2(-2u^2+6u-3)/2 + (u-1)^2/2} & u \in (1, 2) \end{cases}$$

$$\frac{w_2(3-u)^2/2}{w_2(3-u)^2/2 + (-3u^2+14u-15)/2 + (u-2)^2} \quad u \in (2, 3)$$

$$R_{32}(u) = \frac{w_3 N_{32}(u)}{\sum_{i=0}^4 w_i N_{i2}(u)} = \begin{cases} \frac{(u-1)^2/2}{(2-u)^2/2 + w_2(-2u^2+6u-3)/2 + (u-1)^2/2} & u \in (1, 2) \\ \frac{(3u^2+14u-15)/2}{w_2(3-u)^2/2 + (-3u^2+14u-15)/2 + (u-2)^2} & u \in (2, 3) \end{cases}$$

$$R_{42}(u) = \frac{w_4 N_{42}(u)}{\sum_{i=0}^4 w_i N_{i2}(u)} = \frac{(u-2)^2}{w_2(3-u)^2/2 + (-3u^2+14u-15)/2 + (u-2)^2} \quad u \in (2, 3)$$

5)  $w_2 = \begin{matrix} a) & b) & c & d \\ 0 & 0.5 & 1 & 5 \end{matrix}$

a)  $1\rho(u) = \frac{(1-u)^2}{1-u^2/2} V_0 + \frac{(4-3u)u}{2-u^2} V_1 + 0 \cdot V_2 \quad \langle 0,1 \rangle$

$2\rho(u) = \frac{(2-u)^2}{5-6u+2u^2} V_1 + 0 \cdot V_2 + \frac{(u-1)^2}{5-6u+2u^2} V_3 \quad \langle 1,2 \rangle$

$3\rho(u) = 0 \cdot V_2 + \frac{15-14u+3u^2}{7-6u+u^2} V_3 + \frac{2(2+u)^2}{-7+6u-u^2} V_4 \quad \langle 2,3 \rangle$

b)  $w_2 = \frac{1}{2}$   $1\rho(u) = \frac{(1-u)^2}{1-0.25u^2} V_0 + \frac{(4-3u)u}{2-0.5u^2} V_1 + \frac{0.25u^2}{1-0.25u^2} V_2 \quad \langle 0,1 \rangle$

$2\rho(u) = \frac{(2-u)^2}{3.5-3u+u^2} V_1 + \frac{0.25(-3+6u-2u^2)}{1.75-1.5u+0.5u^2} V_2 + \frac{(u-1)^2}{3.5-0.5u^2} V_3 \quad \langle 1,2 \rangle$

$3\rho(u) = \frac{0.25(3-u)^2}{-1.25+1.5u-0.25u^2} V_2 + \frac{-15+14u-3u^2}{-2.5+3.5u-0.5u^2} V_3 + \frac{(u-2)^2}{-1.25+1.5u-0.25u^2} V_4 \quad \langle 2,3 \rangle$

c)  $w_2 = 1$   $1\rho(u) = (1-u)^2 V_0 + \frac{(4-3u)u}{2} V_1 + \frac{u^2}{2} V_2 \quad \langle 0,1 \rangle$

$2\rho(u) = \frac{(2-u)^2}{2} V_1 + \frac{-3+6u-2u^2}{2} V_2 + \frac{(u-1)^2}{2+6u-3u^2} V_3 \quad \langle 1,2 \rangle$

$3\rho(u) = \frac{(3-u)^2}{2} V_2 + \frac{-15+14u-3u^2}{2} V_3 + (u-2)^2 V_4 \quad \langle 2,3 \rangle$

d)  $w_2 = 5$   $1\rho(u) = \frac{(1-u)^2}{1+u^2} V_0 + \frac{(4-3u)u}{2+4u^2} V_1 + \frac{5u^2}{2+4u^2} V_2 \quad \langle 0,1 \rangle$

$2\rho(u) = \frac{(2-u)^2}{-10+24u-8u^2} V_1 + \frac{5(-3+6u-2u^2)}{-10+24u-8u^2} V_2 + \frac{(u-1)^2}{-10+54u-23u^2} V_3 \quad \langle 1,2 \rangle$

$3\rho(u) = \frac{5(3-u)^2}{38-24u+4u^2} V_2 + \frac{-15+14u-3u^2}{38-24u+4u^2} V_3 + \frac{(u-2)^2}{19-12u+2u^2} V_4 \quad \langle 2,3 \rangle$