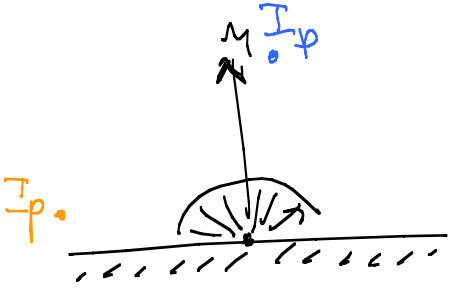
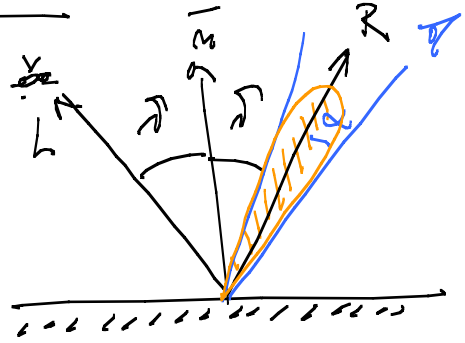
ZPG - 4

Note Title 17.10.2008

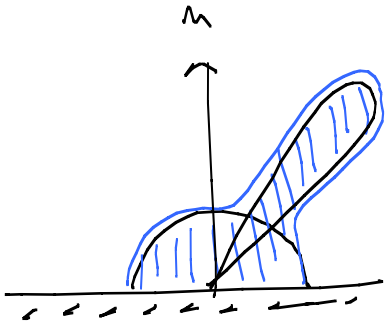
Osvětlení a stínování

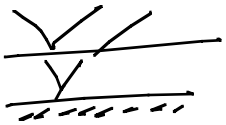


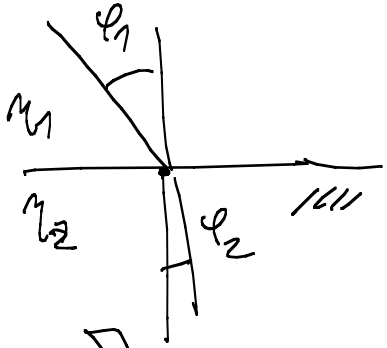
difuzní



zrcadlový





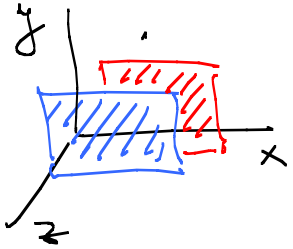


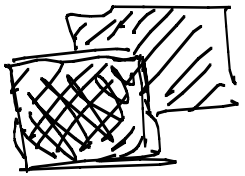
$$\underline{I} = \underline{I}_a + \underline{I}_d + \underline{I}_s + \underline{I}_t$$

(difuzní, ambientní, spekulární (zrcadlový))

$$\underline{I}_a = k_a \underline{I}_a$$

$$\underline{I}_d = k_d \cdot \underline{I}_p \cdot \cos\vartheta$$





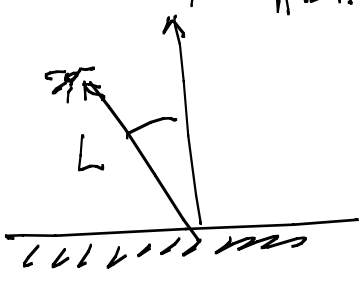
Vliv vzdálenosti ------/$(k_0 + k_1 d + k_2 d^2)$

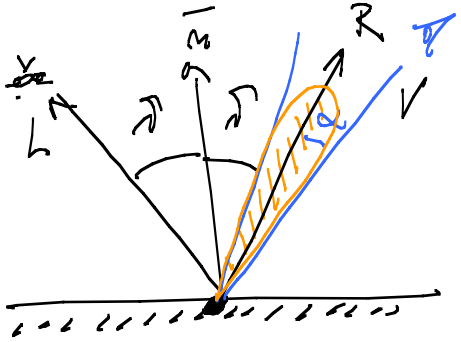
/vzdálenost pozorovatele od plochy [m]

$$\cos\varphi = \frac{L^T n}{\|L\| \cdot \|n\|} = \hat{L}^T \hat{n}$$

$$I_d = k_d I_p \cdot L^T N \;/\;(k_0 + k_1 d + k_2 d^2)$$

/$k_{d_R}, k_{d_B}, k_{d_G}$



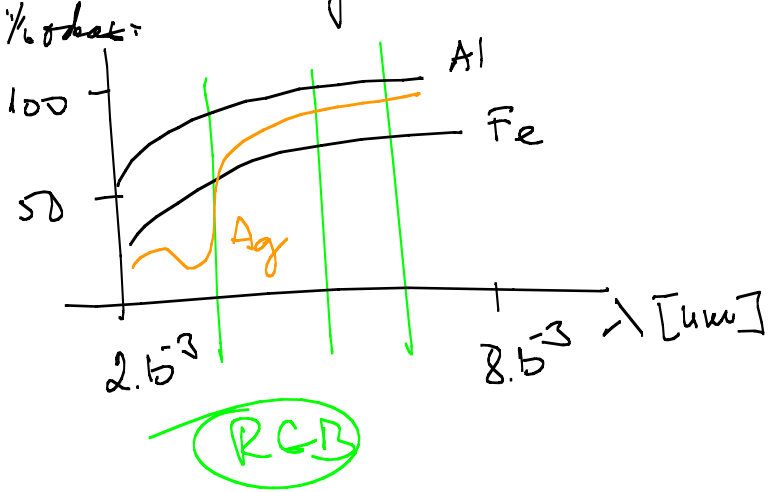


zrcadlový

$$I_S = k_S \cdot I_p \underbrace{w(\vartheta, \lambda)}_{I_R} \cos^m \alpha$$

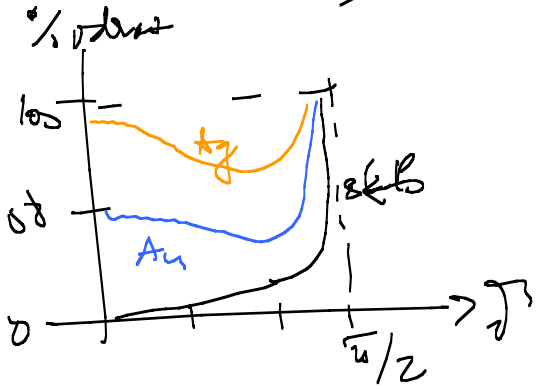
$m \in (1, \infty)$

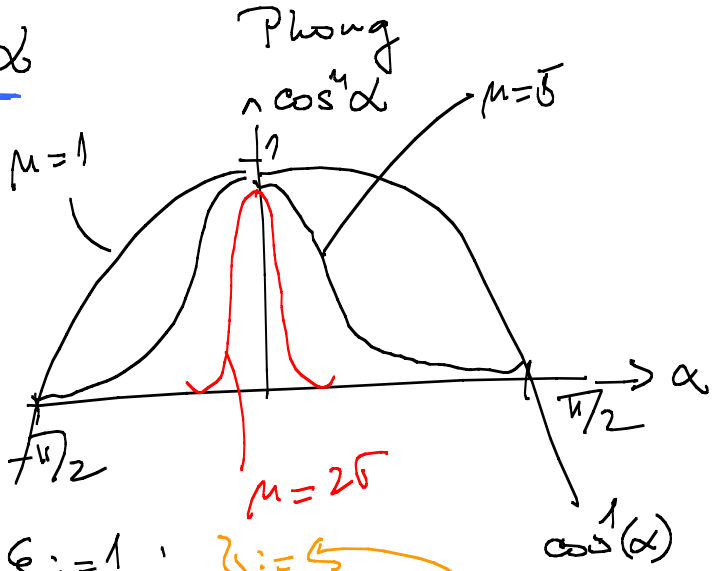
$m - 50 - 100$



RGB

$\cos^M(\alpha)$






```
ξ := 1 ;  ζ := ξ
for i := 1 to m do
    ξ := ξ * cos(α)
```

$\zeta = \cos\alpha$; $\zeta = \zeta * \zeta$ (2)

$\zeta = \zeta * \zeta$ (4) $\xi = \zeta * \zeta$ (8)

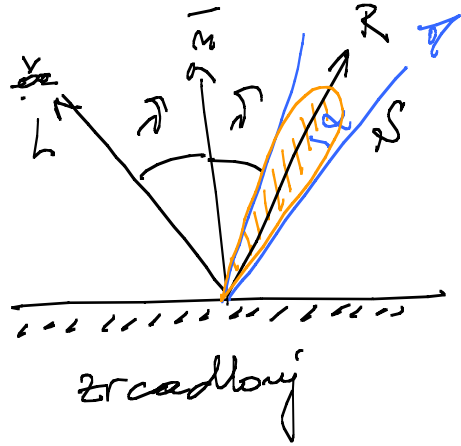
$$I_s = k_s I_p (R^T S)^n$$

↑ vlastnosti materiálu

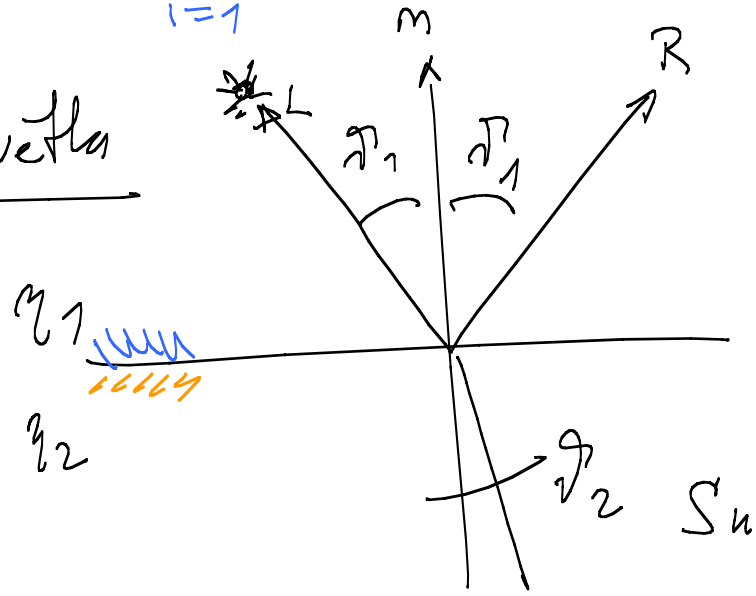
$$\cos^n \alpha = (\hat{R}^T \hat{S})^n$$

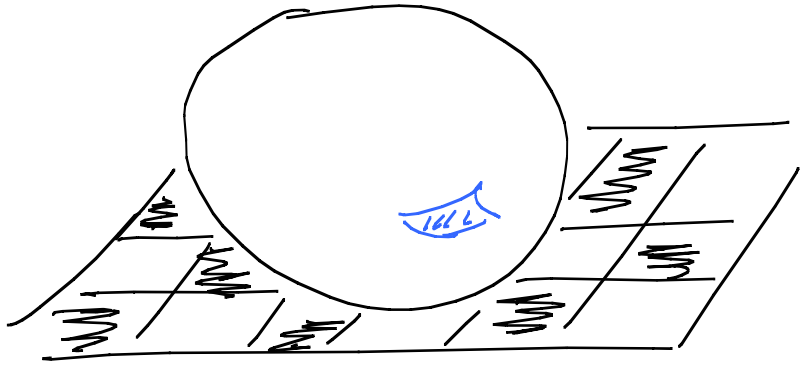
dále: $\|\hat{R}\| = 1$, $\|\hat{S}\| = 1$

$$I = k_a I_a + \sum_{i=1}^{m} I_{p_i} \left[k_d \cdot \cos\vartheta + k_s \cos^n \alpha \right] / \left(k_0 + k_1 d + k_2 d^2 \right)$$

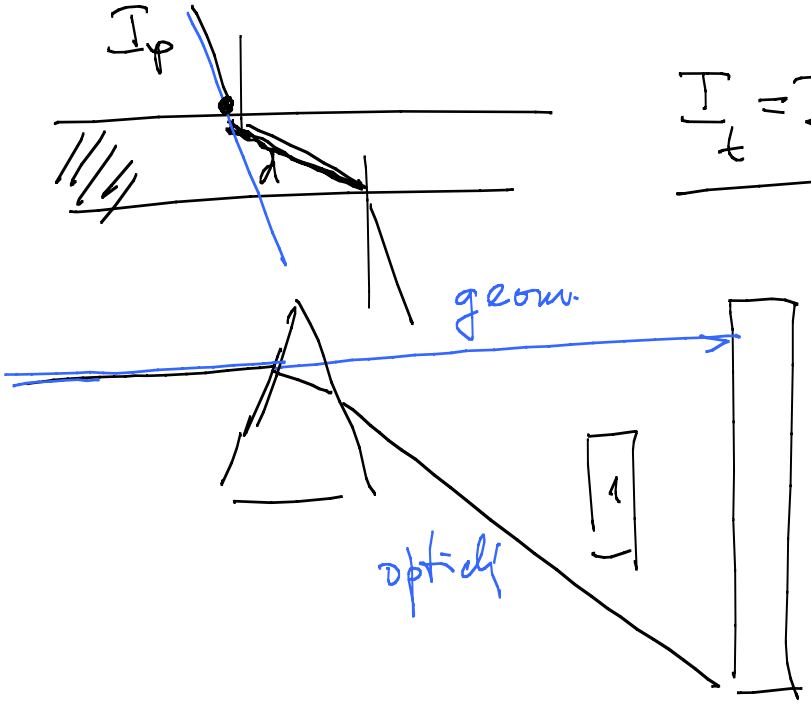


Lom světla





Snell $\eta_1 \cdot \sin\vartheta_1 = \eta_2 \cdot \sin\vartheta_2$



$$I_t = I_p \cdot t \cdot e^{-ad}$$

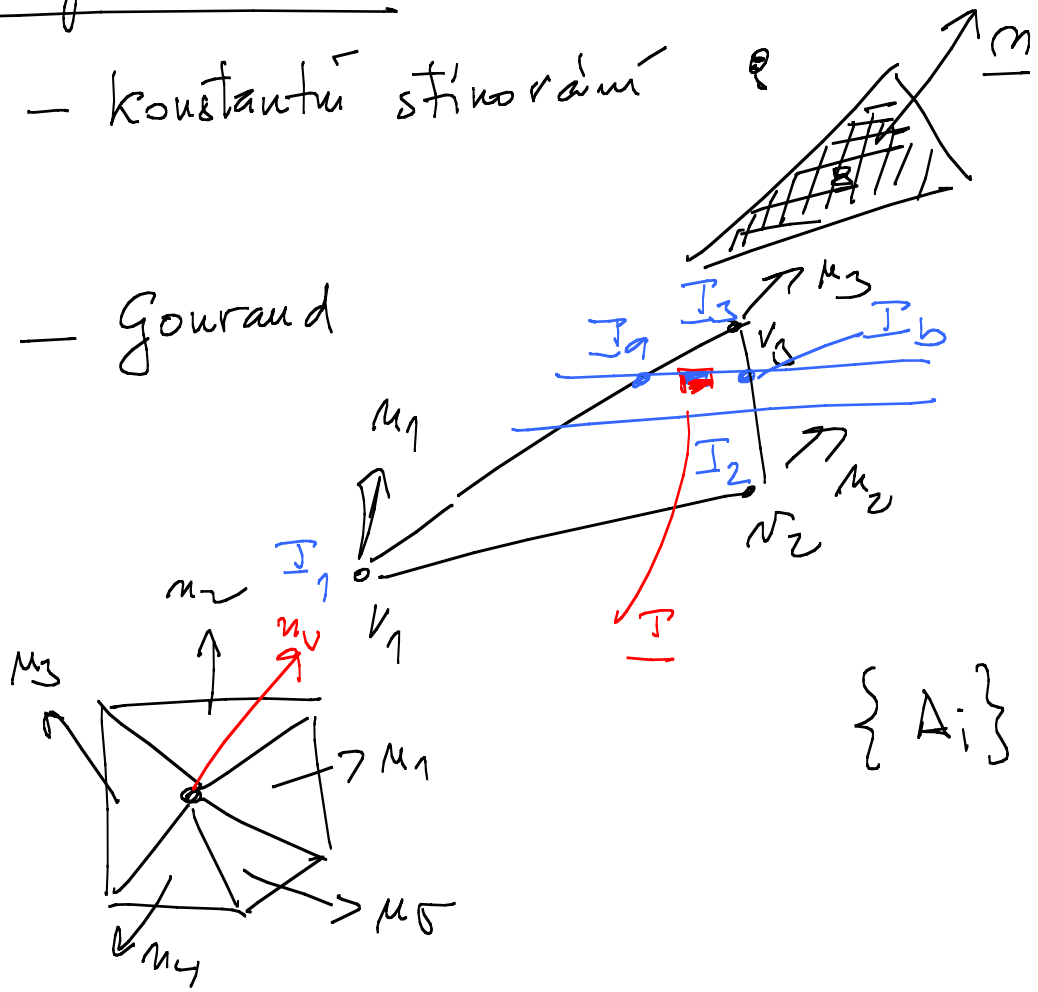
a, t .. materiálové konstanty

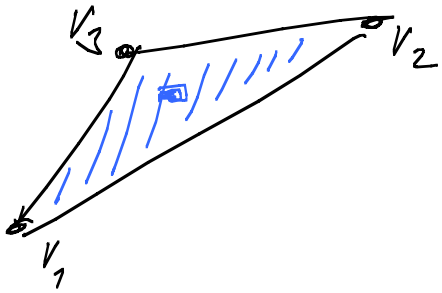
Metody stínování

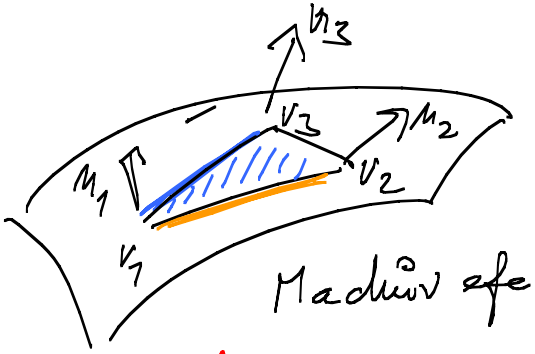
- bod
- trojúhelník

— konstantní stínování

— Gouraud





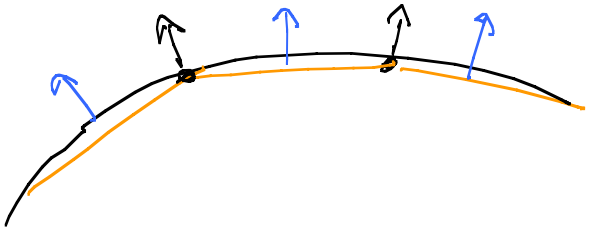


Machův efekt

$\{A_i\}$

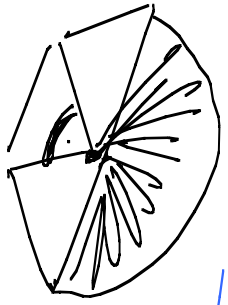
v_1, v_2, v_3 (n_i) $\rightarrow (v_1 - v_2) \times (v_3 - v_2)$

$n_V = \frac{\sum n_i}{\text{počet}_\Delta}$ ⌀ !! více metod

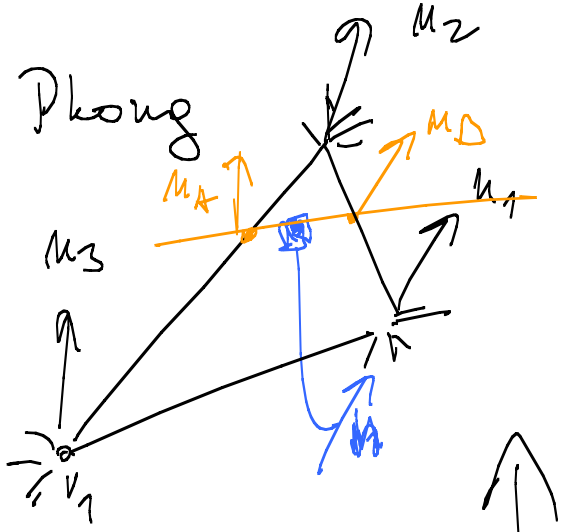


— kvadratický odhad

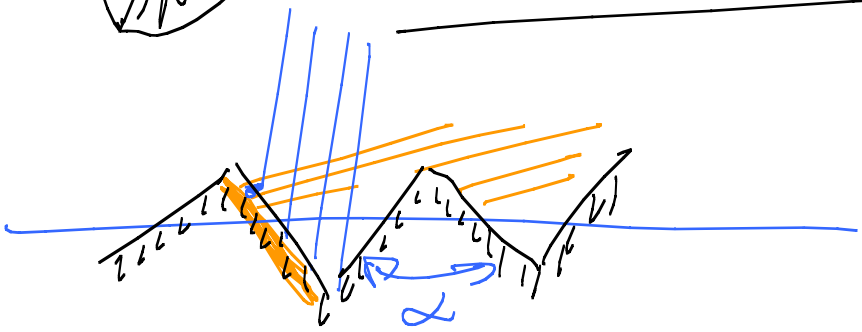
— mlhy



— Phong



Torrance - Sparrow

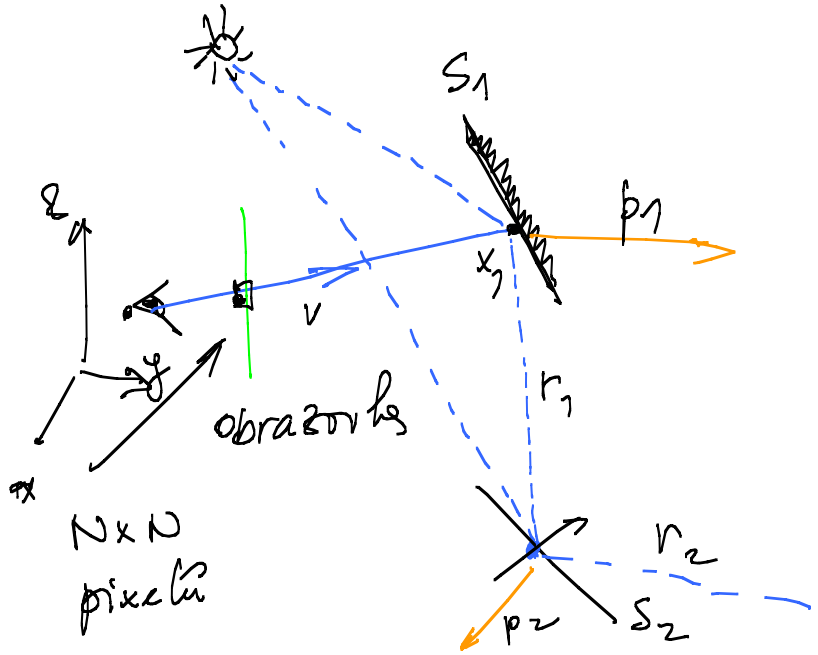


Lokální modely stínování X GLOBÁLNÍ

Globální metody

— Radiační metody — difuzní plochy

— Sledování paprsků (Ray Tracing) — PovRay

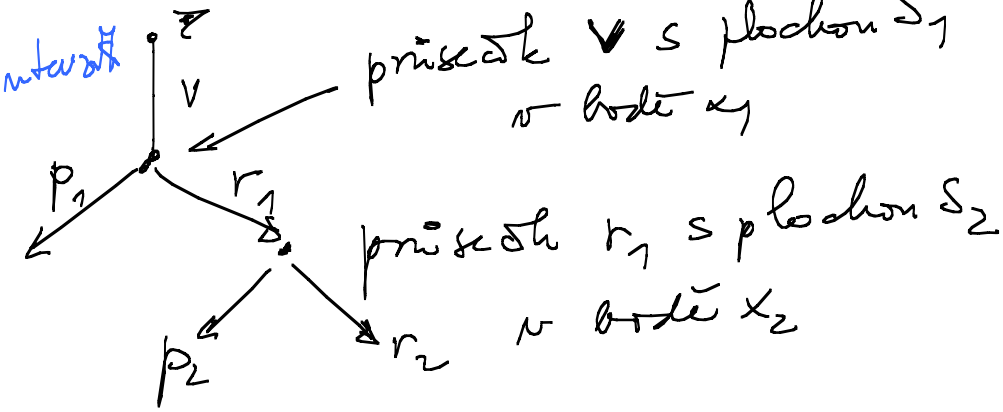


průsečky

intensita

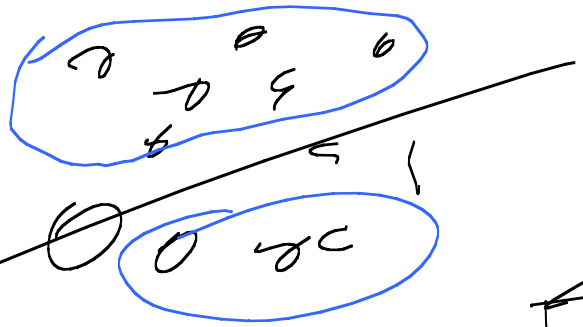
hloubka

příspěvek

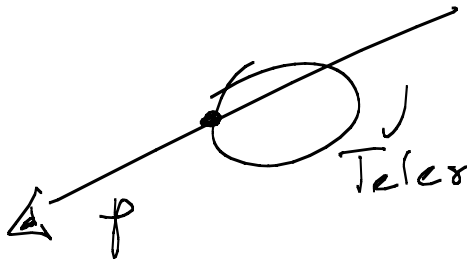


Složitost výpočtu

$O(N^2 M 2^k)$ ← hloubka stromu



M objektů



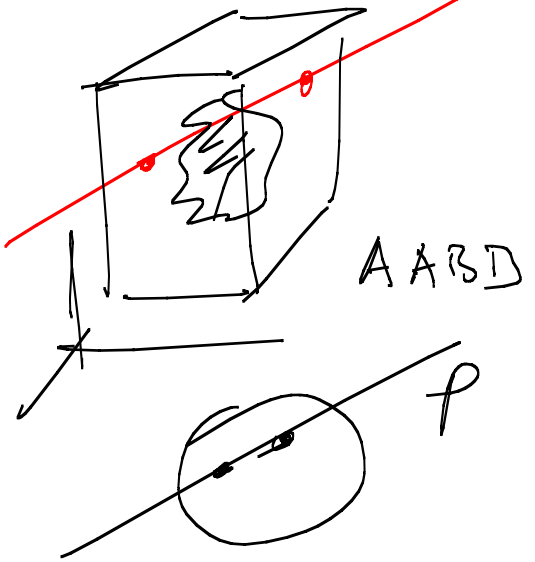
Teleso

1) výpočty průsečíku

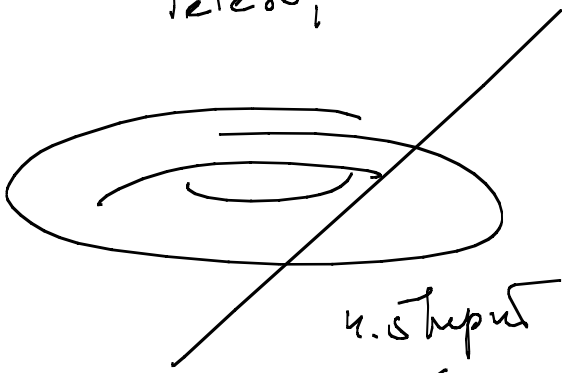
ohraničujících těles

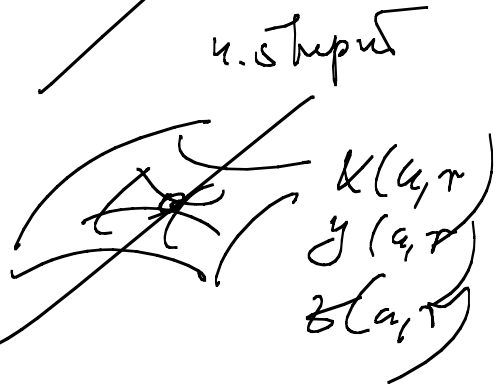
- min max box

- koule



AABB





K(q,r)

y(q,r)

z(q,r)

$$x(t) = x_A + st \quad i \quad (x - x_S)^T (x - x_S) = R^2$$

$$(x_A + st - x_S)^T (x_A + st - x_S) = R^2$$

$\xi = x_A - x_S$

$(st + \xi)^T (st + \xi) = R^2$

$s^T s t^2 + s^T \xi t + \xi^T s t + \xi^T \xi - R^2 = 0$

$\xi^T s = s^T \xi$

$c = \xi^T \xi - R^2$

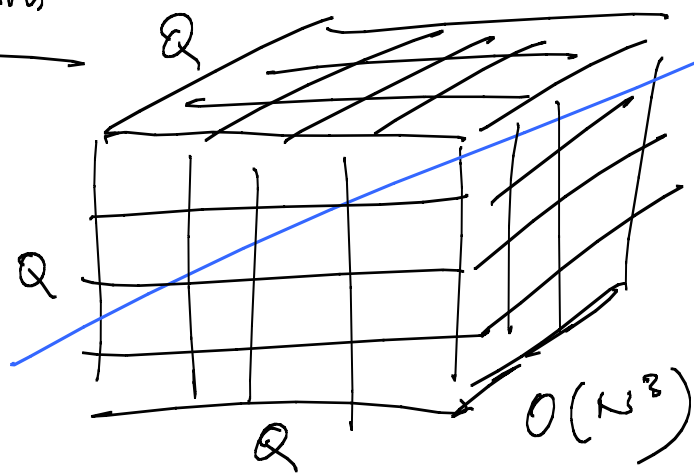
$s^T s t^2 + 2 s^T \xi t + c = 0$

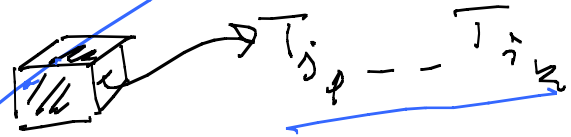
$a = s^T s$ $\quad b = 2 s^T \xi$

$a t^2 + b t + c = 0$

$t_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $\quad D \geq 0$

Delení prostoru

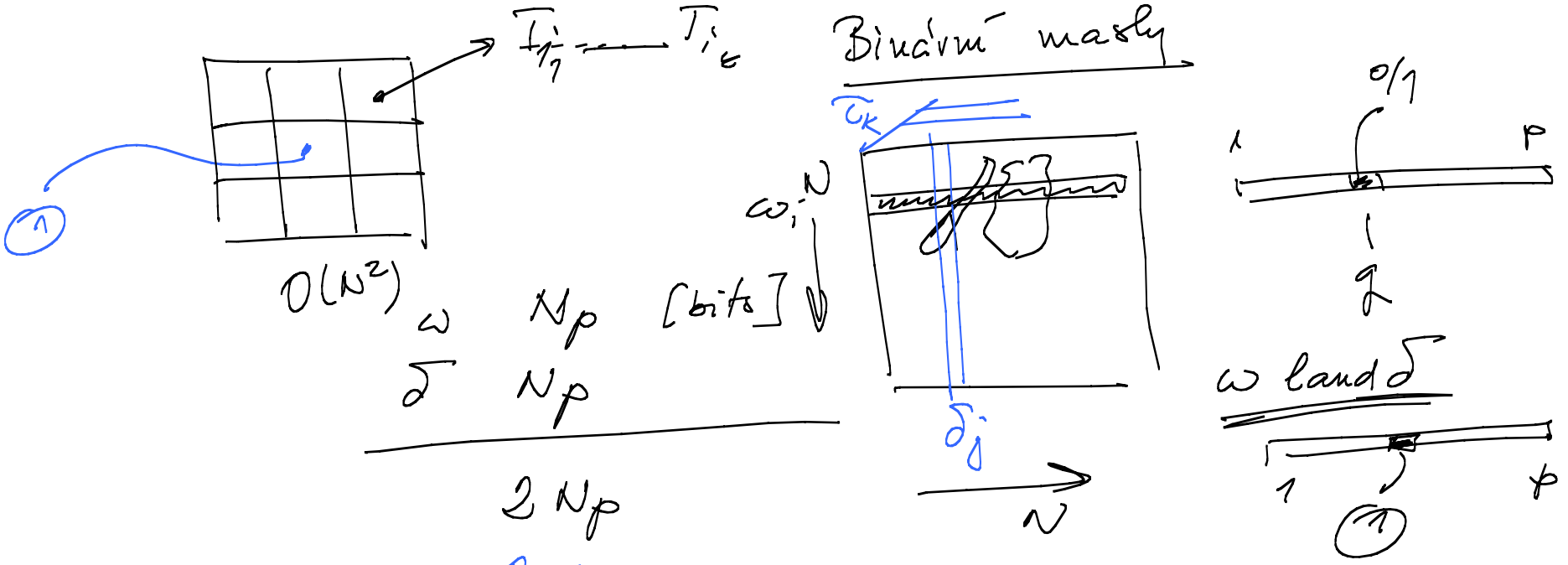




M objektů

$O(Q^3 M)$

8/16/52



⇒ Podstatná úspora paměťové náročnosti !