Curved Geometry in 2 variables

$d = 3$

$(1-u)^3 \quad 3u(1-u)^2 \quad 3u^2(1-u)$

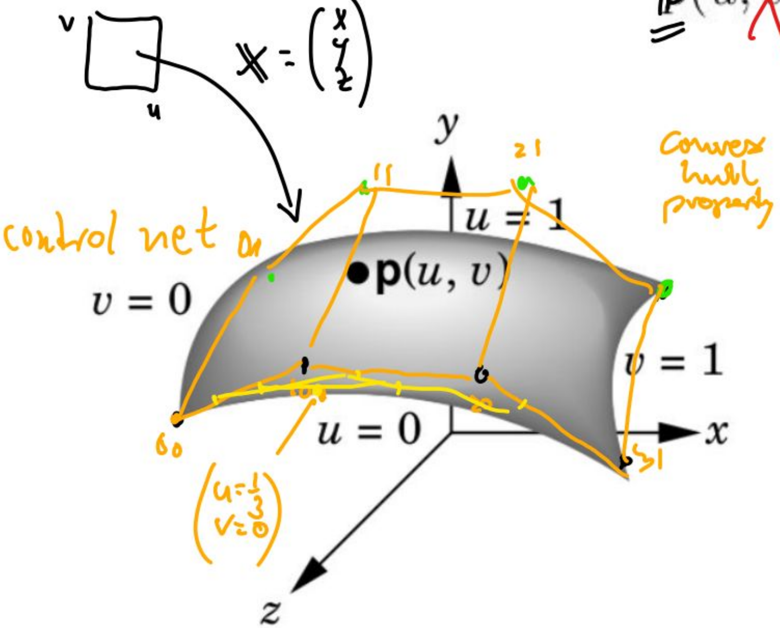
$(B_0(u)\ B_1(u),\ B_2(u),\ B_3(u))$

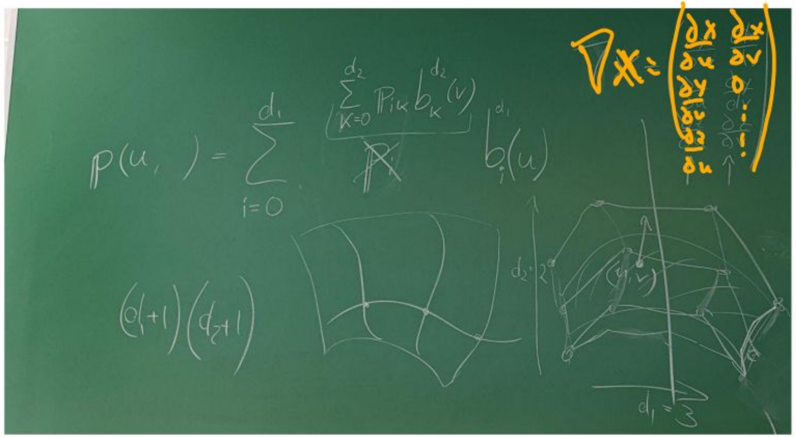
$\mathbf{x} = (\dots B(u) \dots)\,(\ \mathbb{P}\ )_{i,k} \begin{pmatrix} \vdots \\ B(v) \\ \vdots \end{pmatrix} \quad \begin{pmatrix} B_0(v) = (1-v) \\ B_1(v) = v \end{pmatrix}$

Tensor-product BB-form:

$$\mathbf{p}(u, \cancel{v}) = \sum_{i+\cancel{j}=d_1} \cancel{\sum_{k+\cancel{l}=d_2}} \mathbf{p}(i,\cancel{k}) B_{j,i}(u) \cancel{B_{k,l}(v)}$$

$d_1 = 3, \quad d_2 = 1$





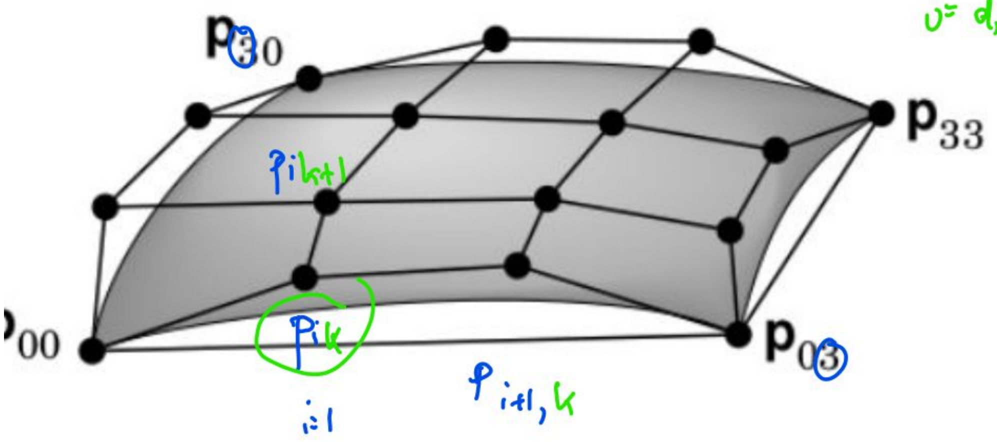
Curved Geometry in 2 variables

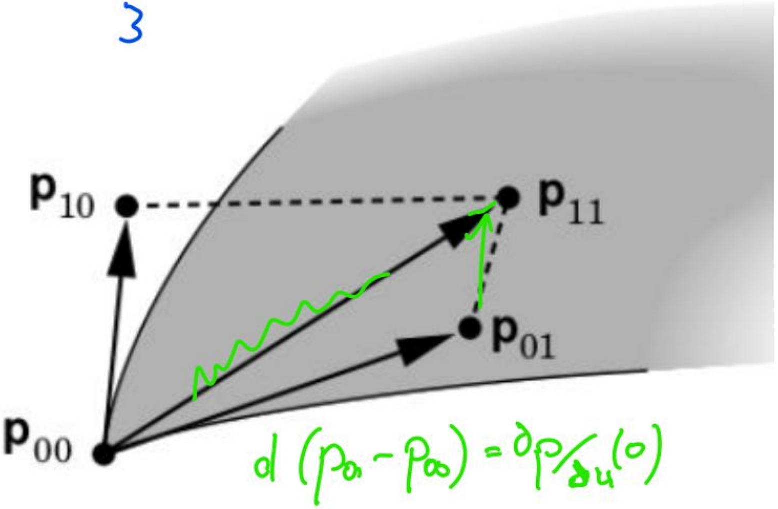
Tensor-product BB-form:

$$p(u,v) = \sum_{\underset{3}{i+j=d_1}} \sum_{\underset{3}{k+l=d_2}} \mathbf{p}(i,k) B^{d_1}_{j,\cancel{i}}(u) B_{k,\cancel{l}}(v)$$

p_{ik}

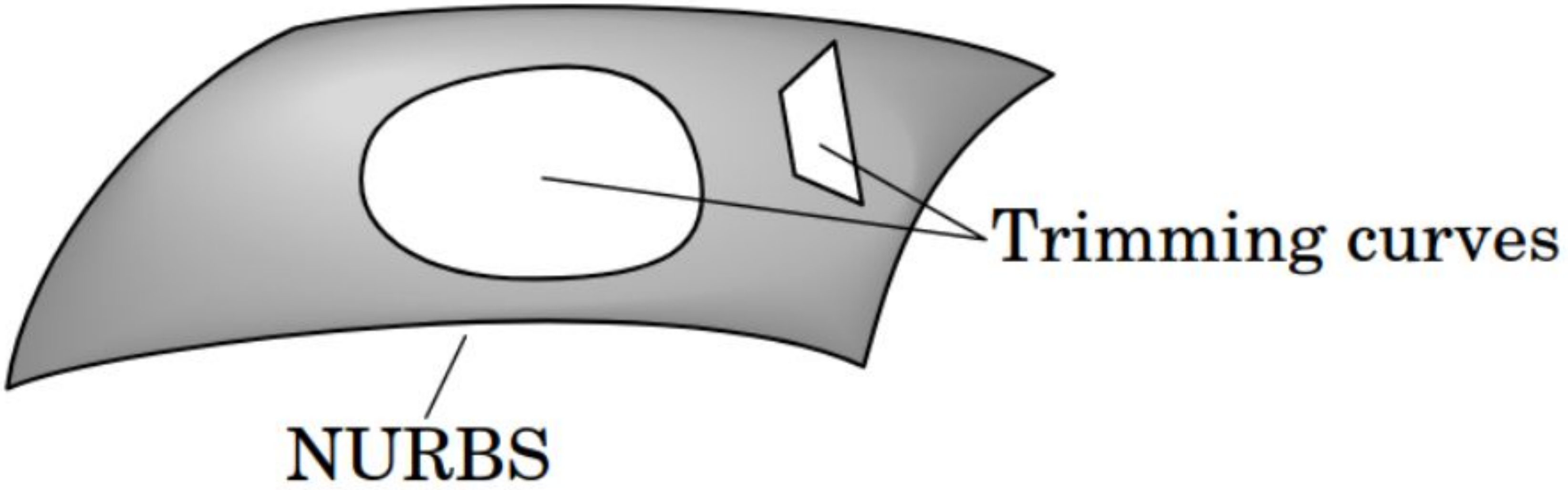
$j = d_1 - i$



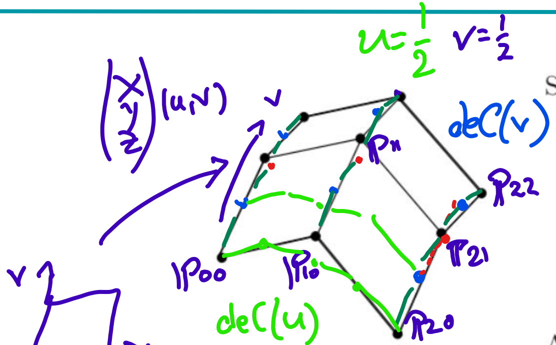


Curved Geometry in 2 variables

NURBS

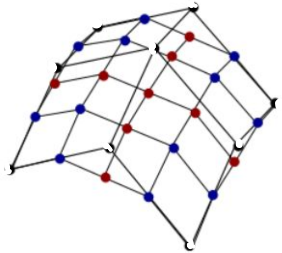


Curved Geometry in 2 variables: deCasteljau



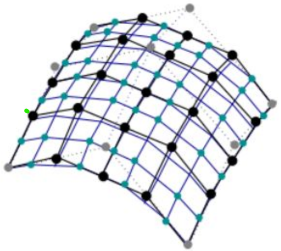
Subdivision begins with a few points connected to form faces

- These are the initial control points used to define the surface



At each step new points are created determined by the surrounding points.

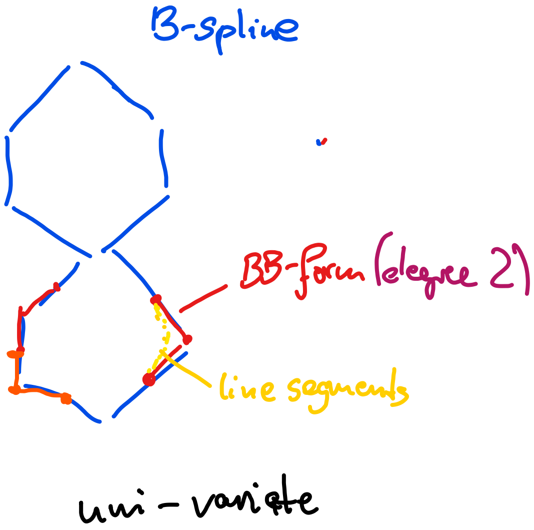
- Original control points
- de Casteljau in front-to-back direction
- Second de Casteljau application

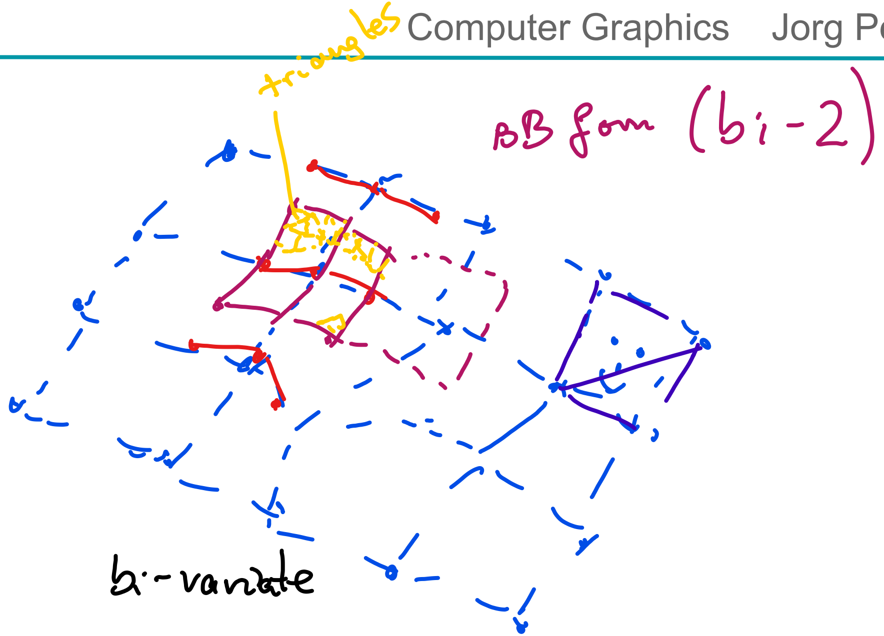


Iteration of de Casteljau=Subdivision

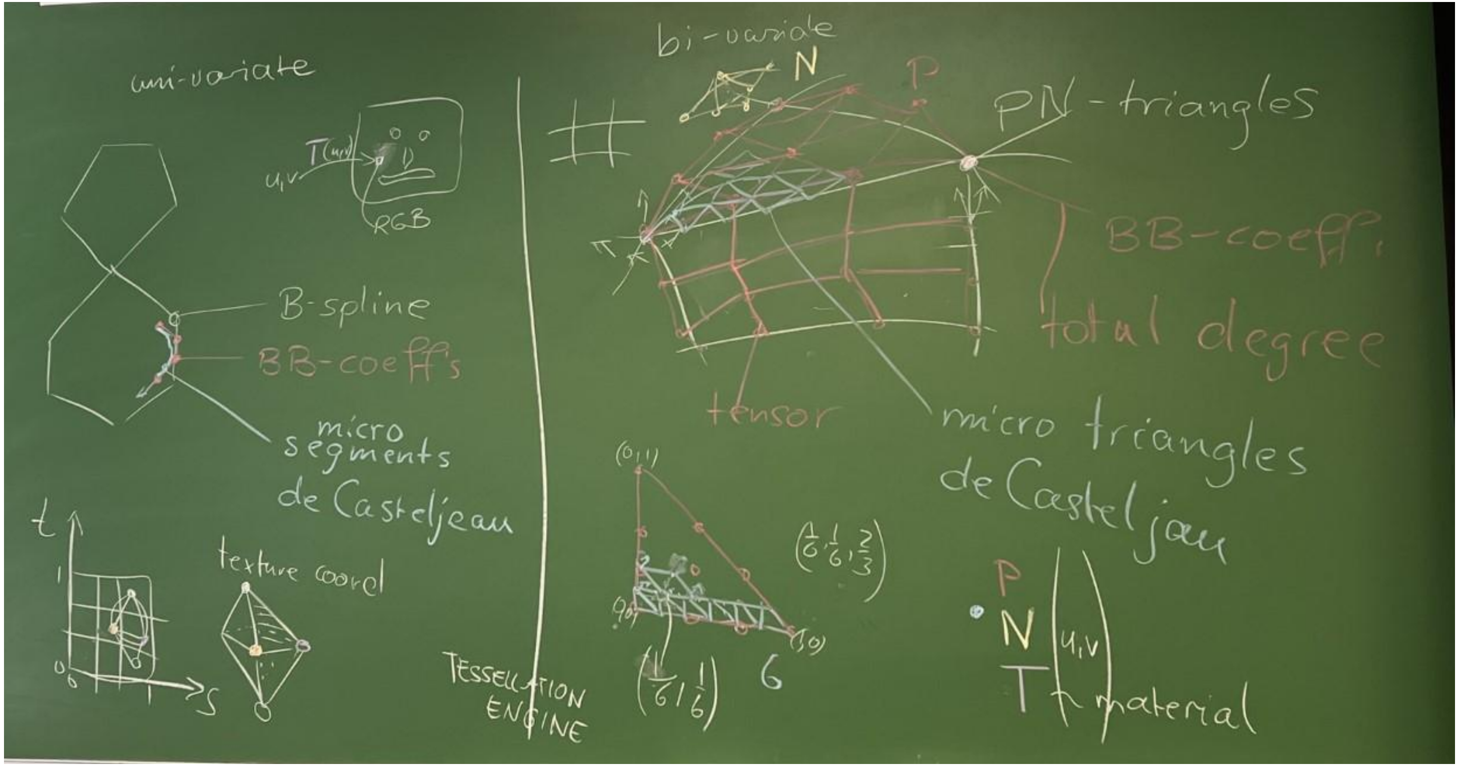
- Input control points
- First Iteration
- Second Iteration

Rendering


B-spline
BB-form (degree 2)
line segments
uni-variate


triangles
BB form (bi-2)
bi-variate

Rendering


uni-variate
T(u,v)
u,v
RGB
B-spline
BB-coeff's
micro
segments
de Casteljeau
texture coord
TESSELLATION
ENGINE
bi-variate
N
P
PN-triangles
BB-coeff.
total degree
tensor
micro triangles
de Casteljau
(0,1)
(1,0)
P
N
T
u,v
material