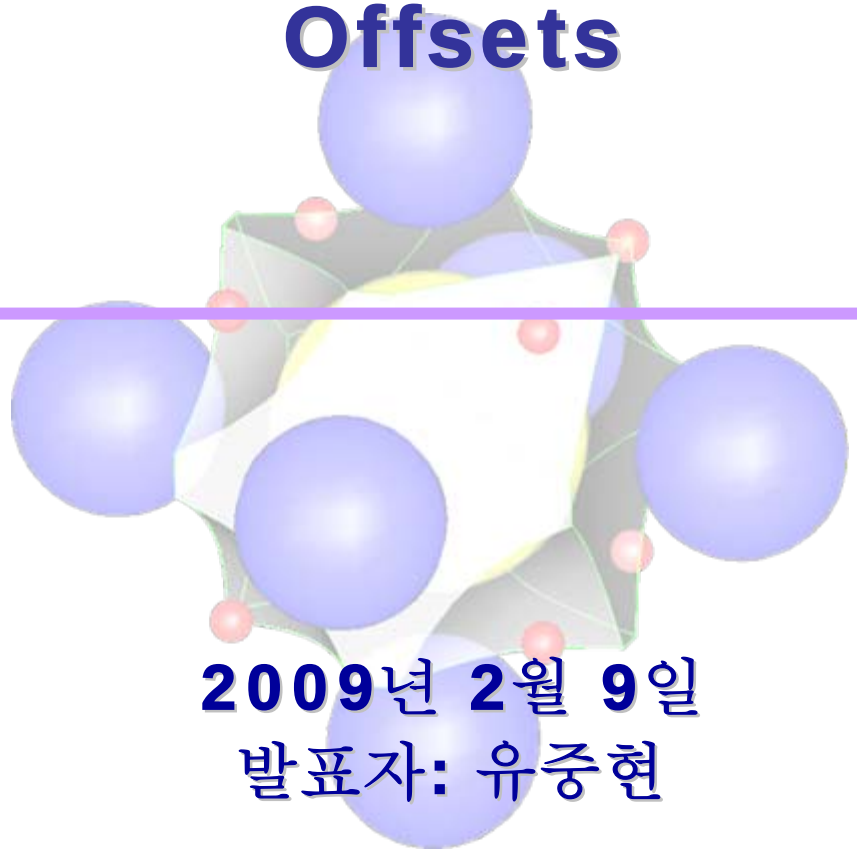
Architectural geometry: Offsets

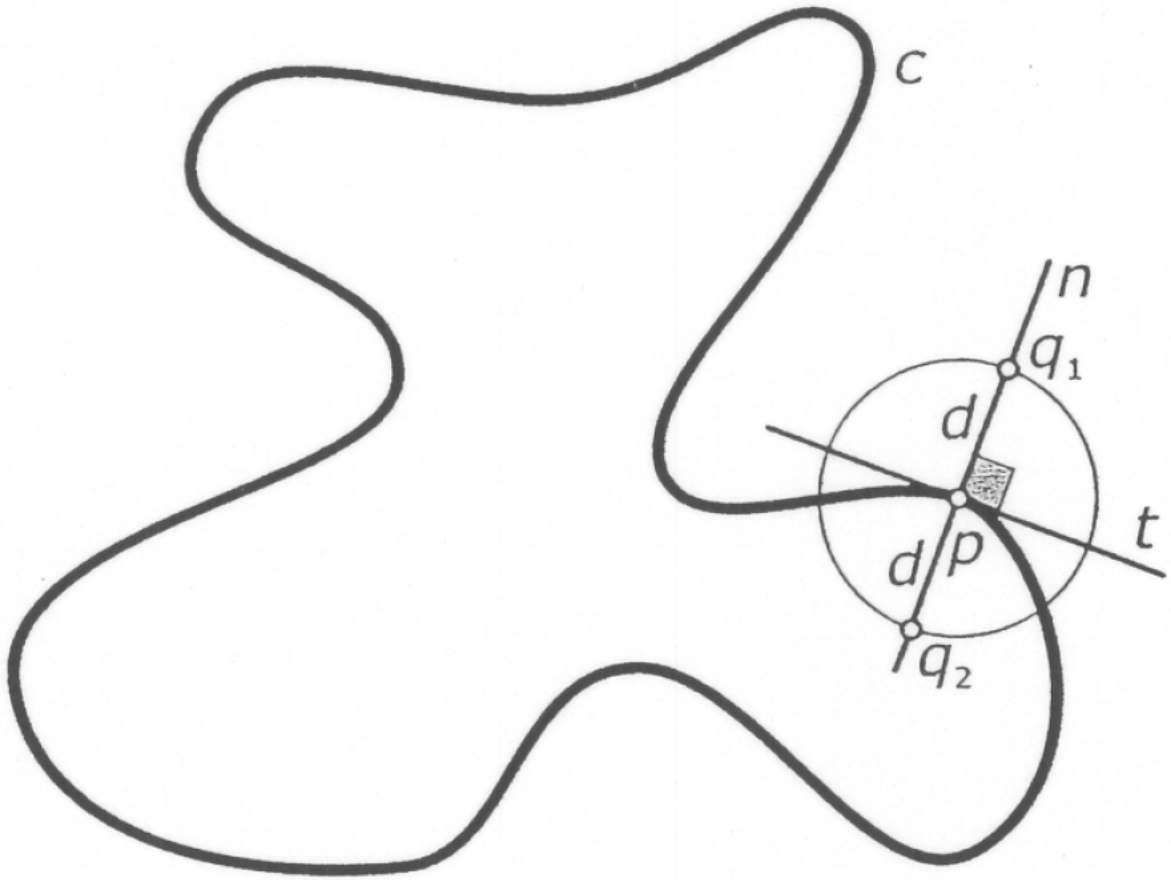


2009년 2월 9일

발표자: 유중현

Offset curve

- **Offset (curve)**
- **Parallel curve**



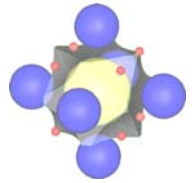
$$\mathbf{c}(t) = (x(t), y(t))$$

$$\mathbf{c}'(t) = (x'(t), y'(t))$$

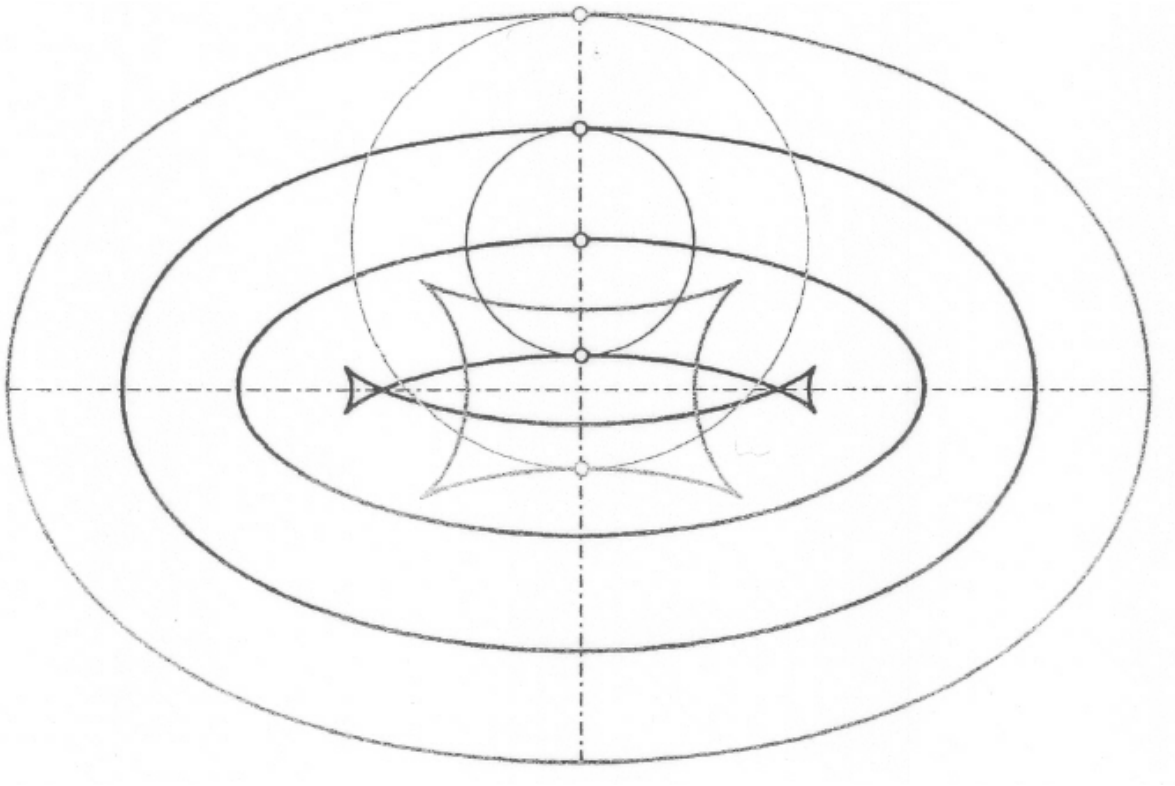
$$\mathbf{n}(t) = \frac{(-y'(t), x'(t))}{\sqrt{x'(t)^2 + y'(t)^2}}$$

$$\mathbf{c}_d(t) = \mathbf{c}(t) \pm d \cdot \mathbf{n}(t)$$

Offset curve



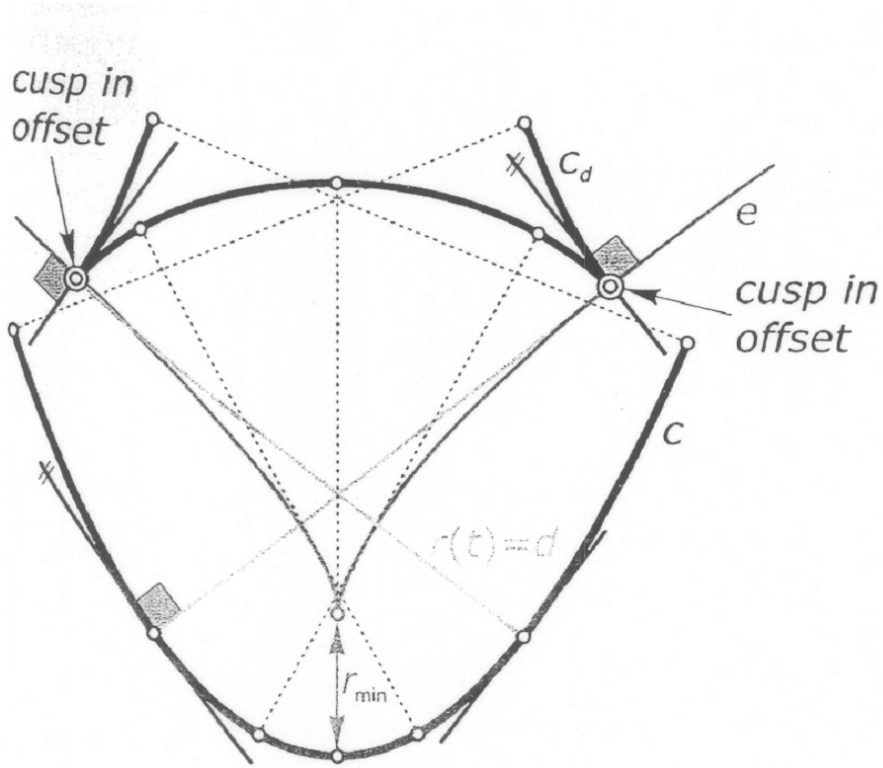
- The offset of a planar curve is not a same type.

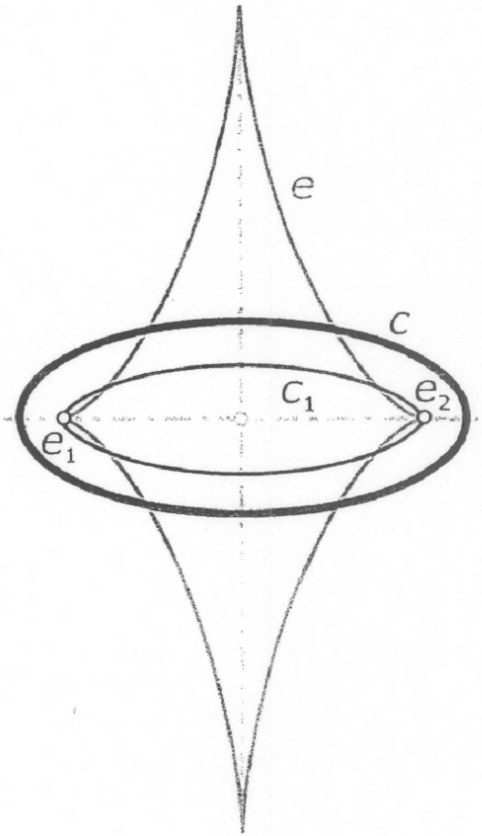


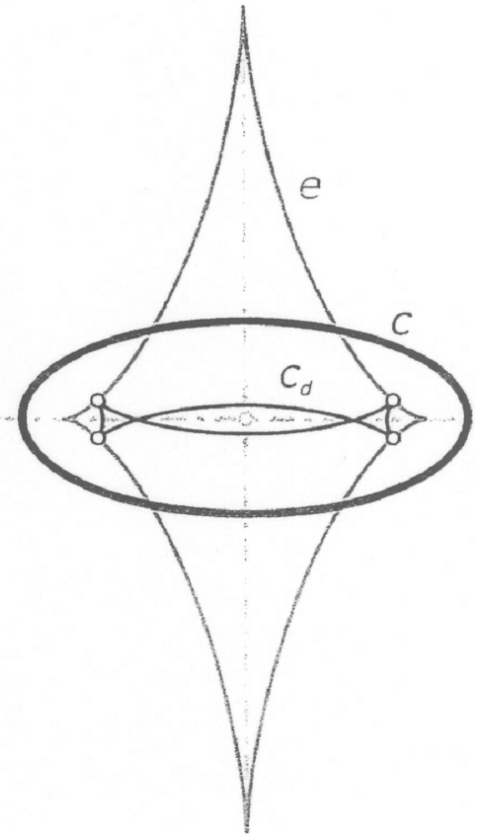
Offset and evolute

$$\mathbf{e}(t) = \mathbf{c}(t) + 1/k(t)\cdot\mathbf{n}(t) \quad \mathbf{c}_d(t) = \mathbf{c}(t) \pm d\cdot\mathbf{n}(t)$$

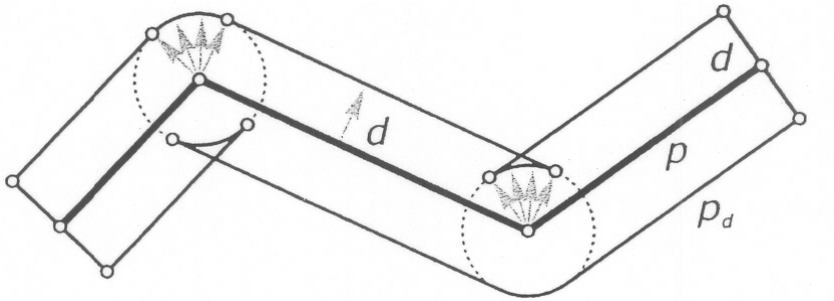
The cusps are those curve points $c_d(t)$ where $d = r(t)$

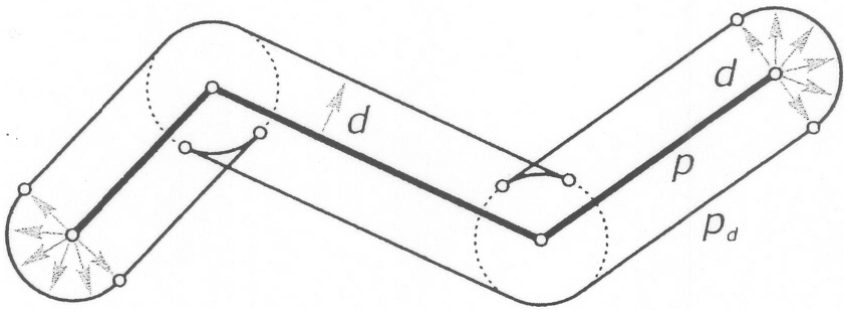




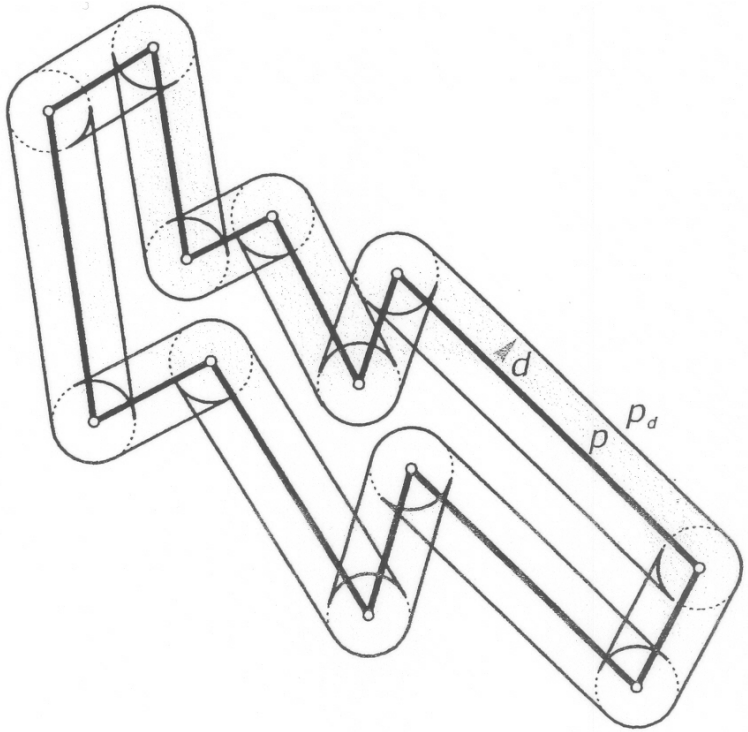


Offsets of planar polygons

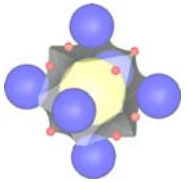




- **Line segments**
- **Circular arcs**



Offset surfaces

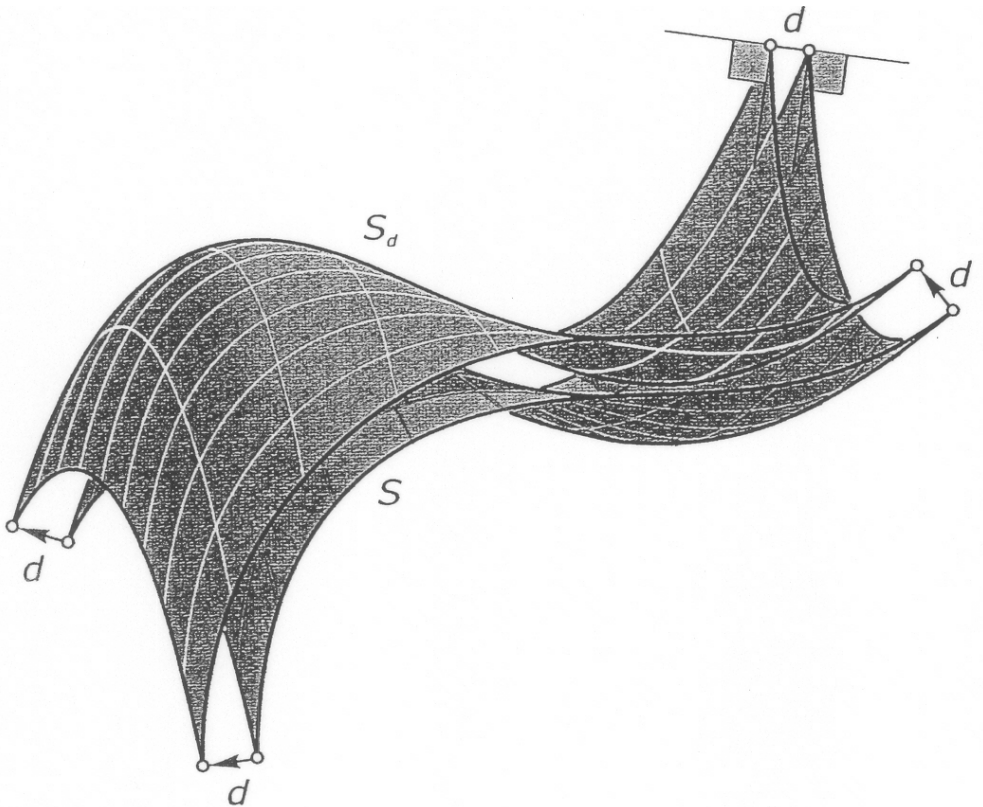


- (Parallel surfaces)

$$\mathbf{S}(u,v) = (x(u,v), y(u,v), z(u,v))$$

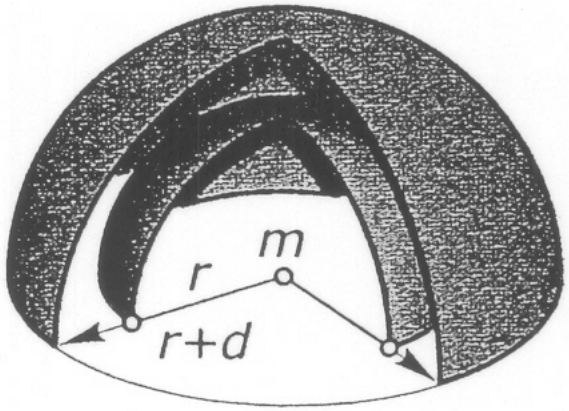
$$\mathbf{S}_d(u,v) = \mathbf{S}(u,v) \pm d \cdot \mathbf{n}(u,v)$$

- Offset invariant surfaces
  - Cylinders
  - Rotational surfaces

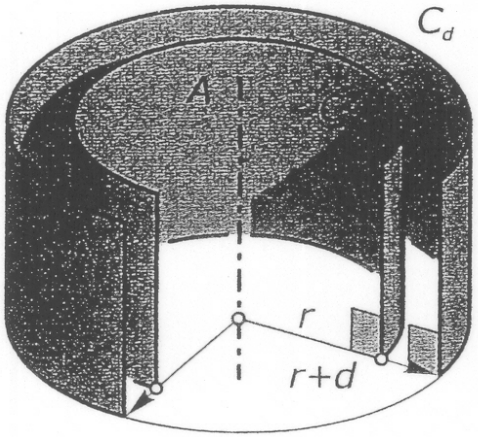


Examples for offset surface

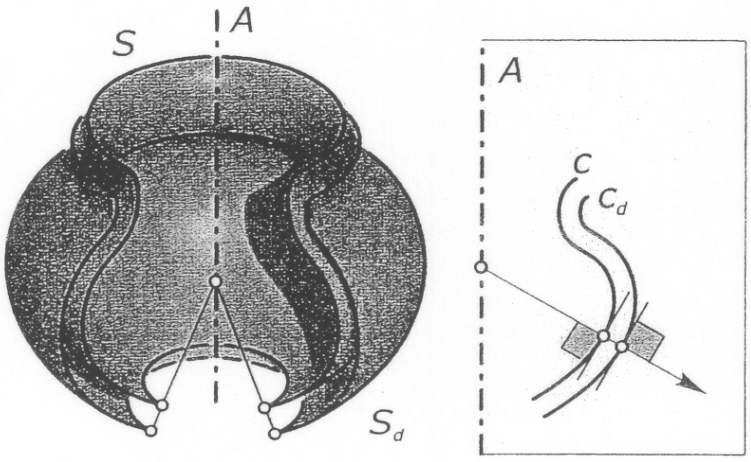
concentric spheres



coaxial rotational cylinders



coaxial rotational surfaces



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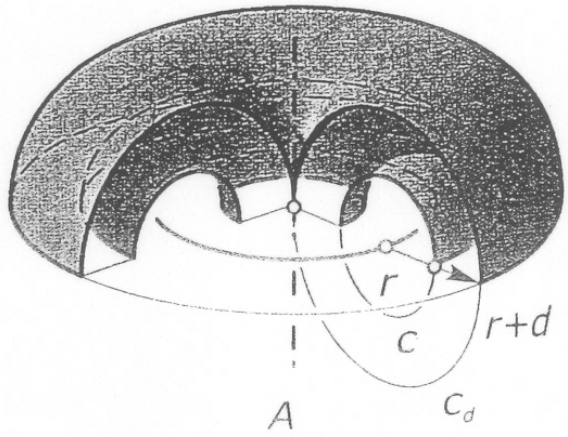
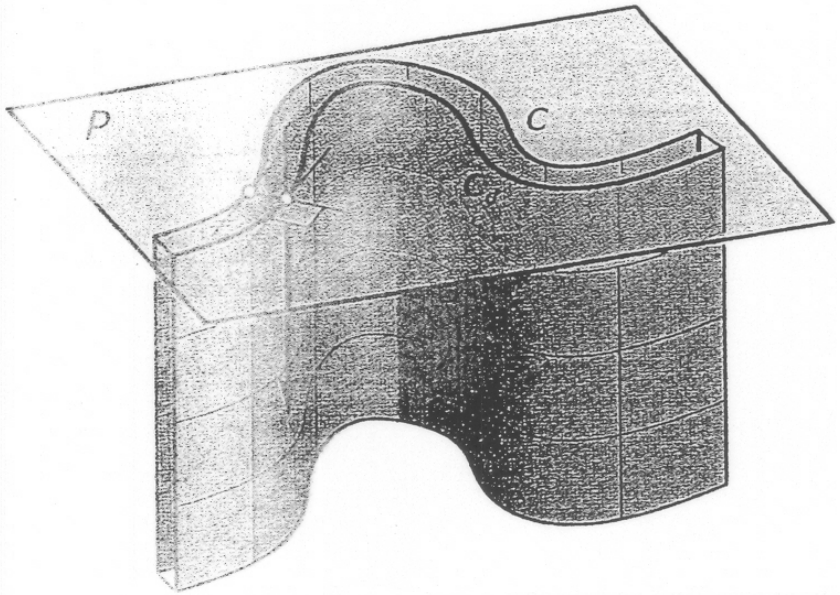
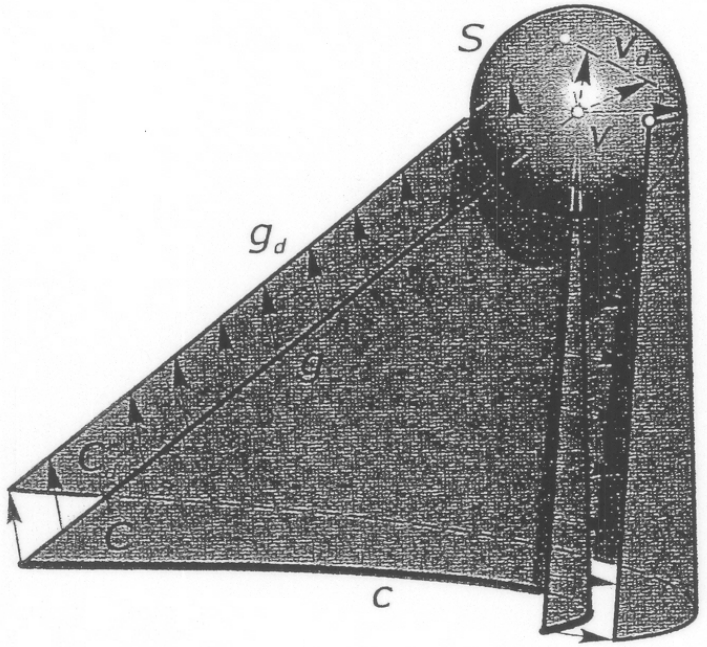
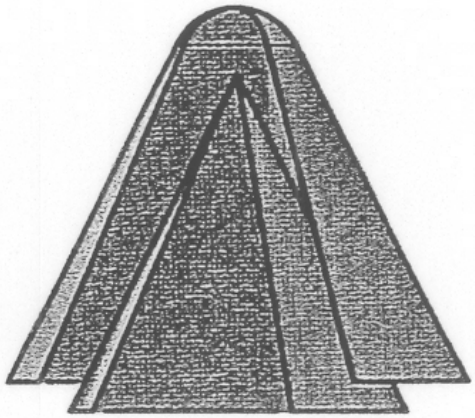


Examples for offset surface

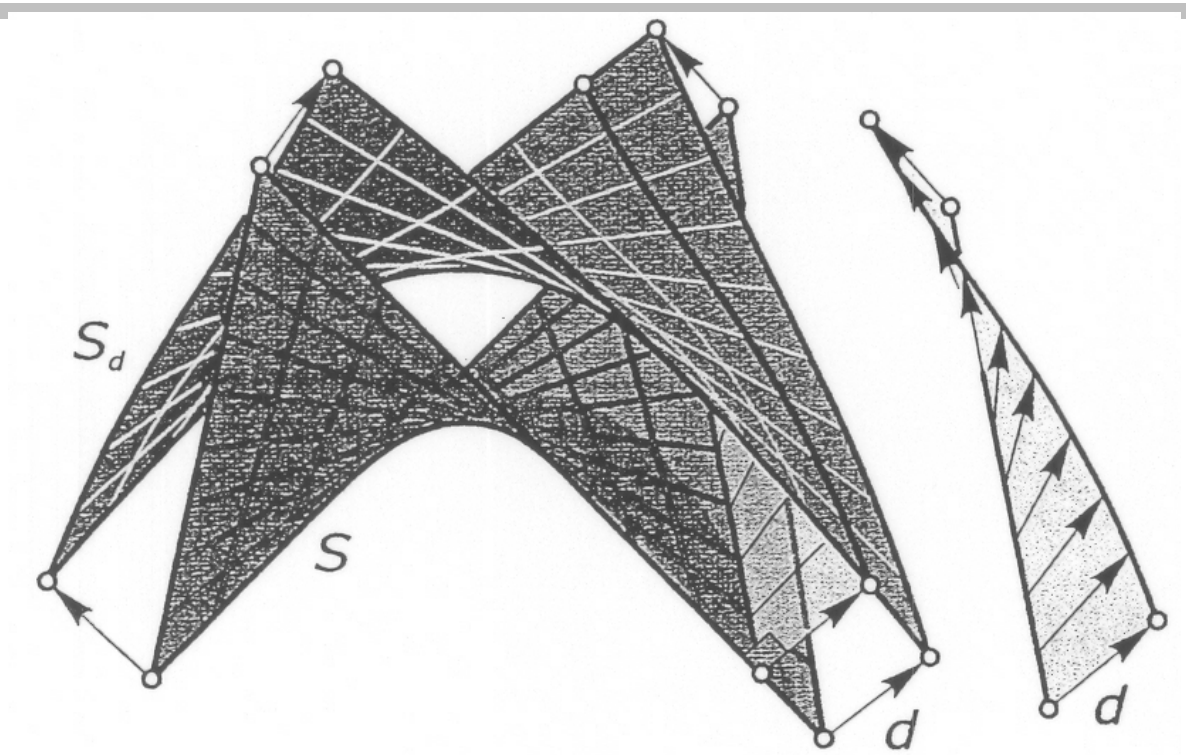


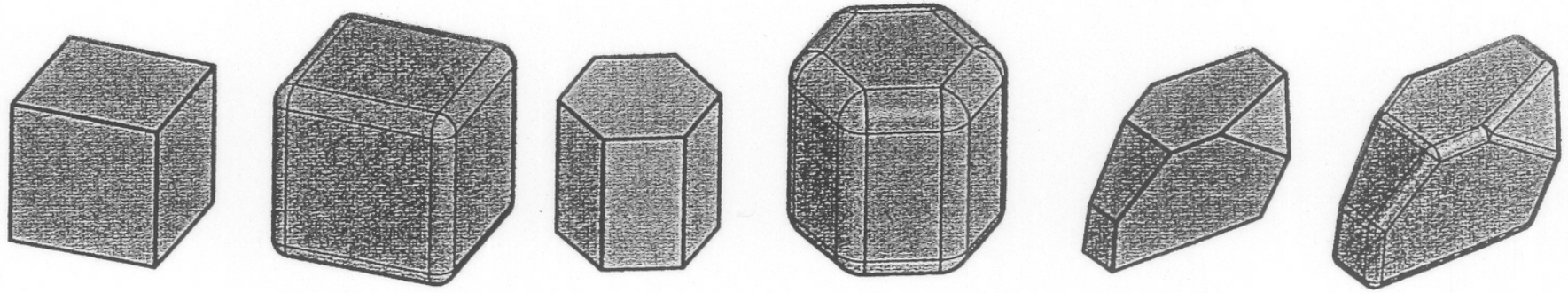


offset of a rotational cone

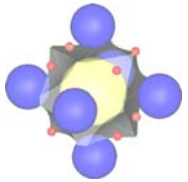


Examples for offset surface

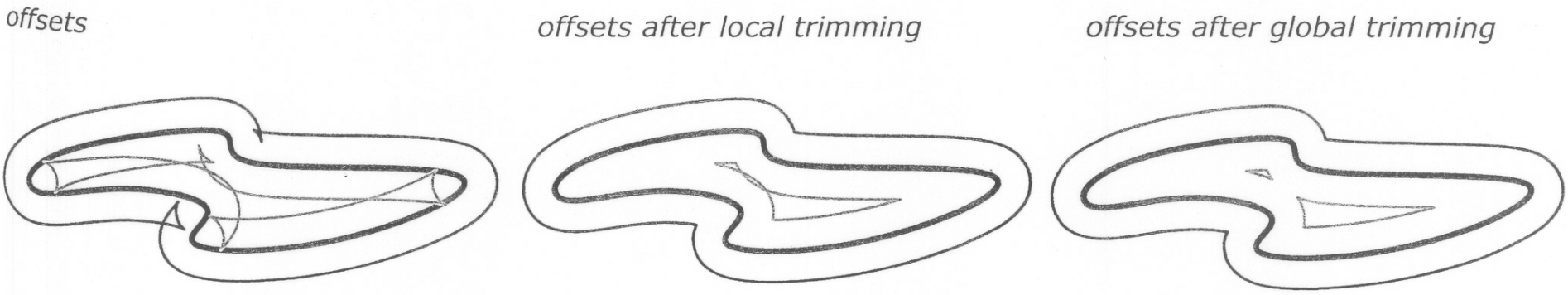




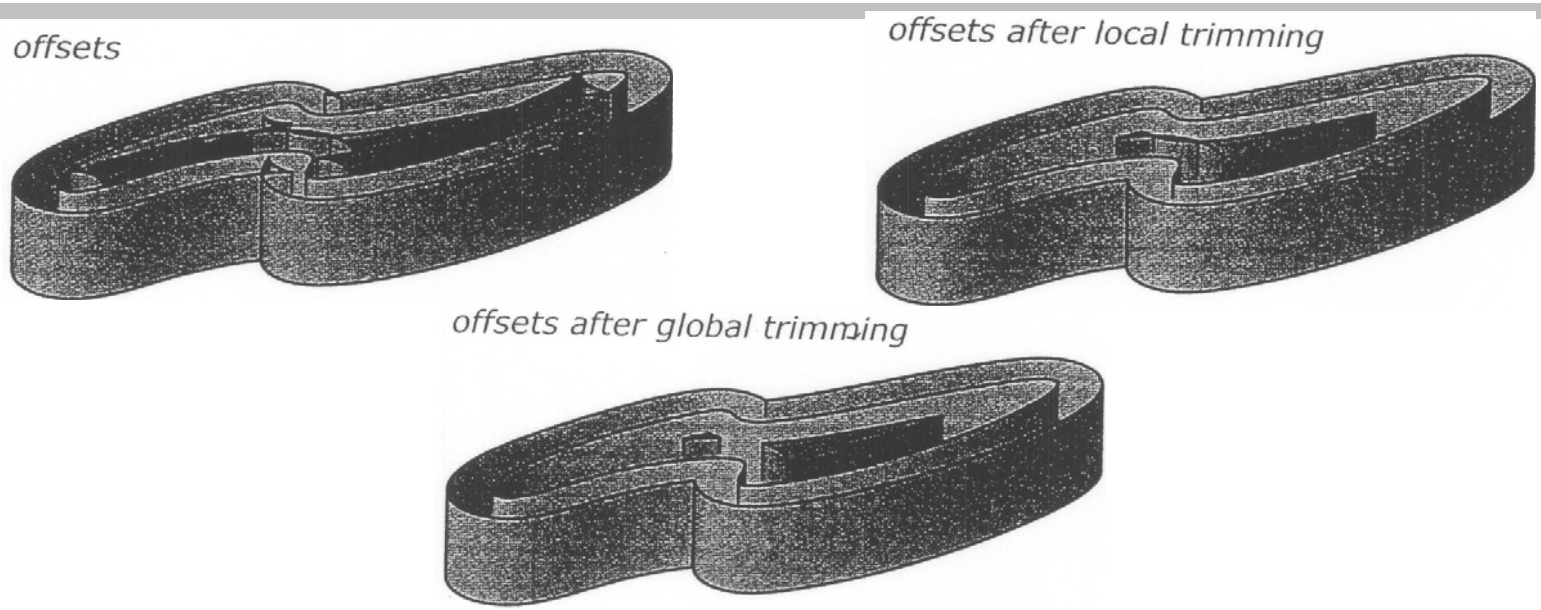
Trimming of offsets

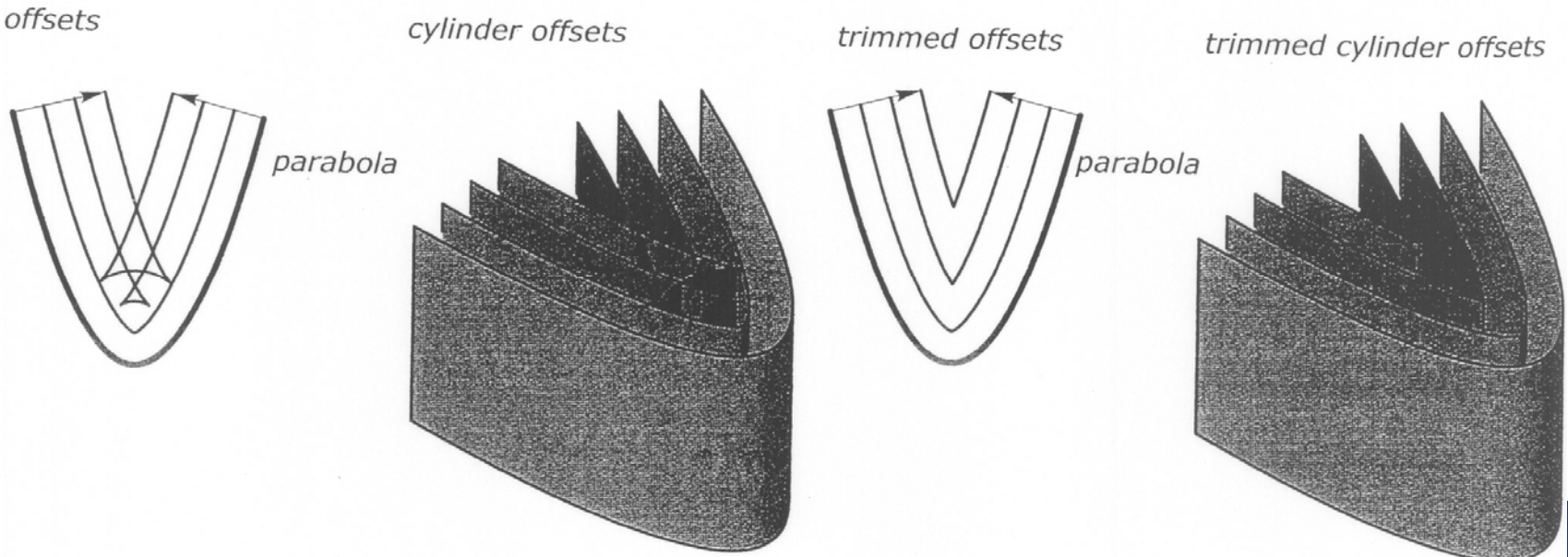


- Local trimming
- Global trimming

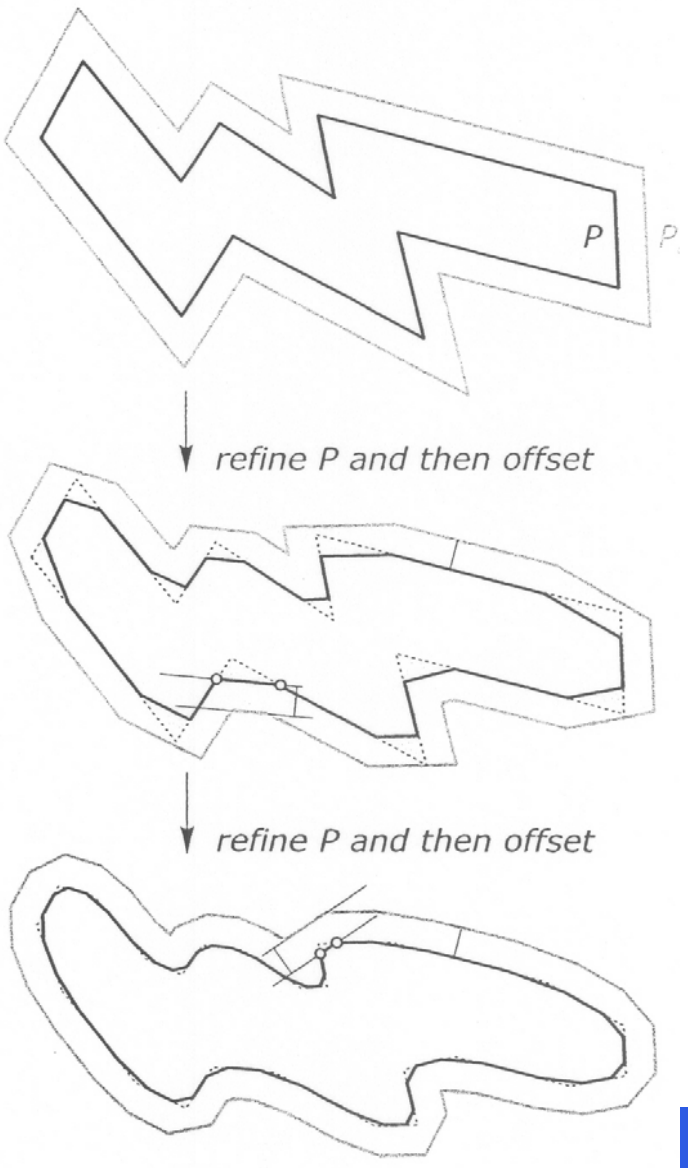


Trimming of offsets

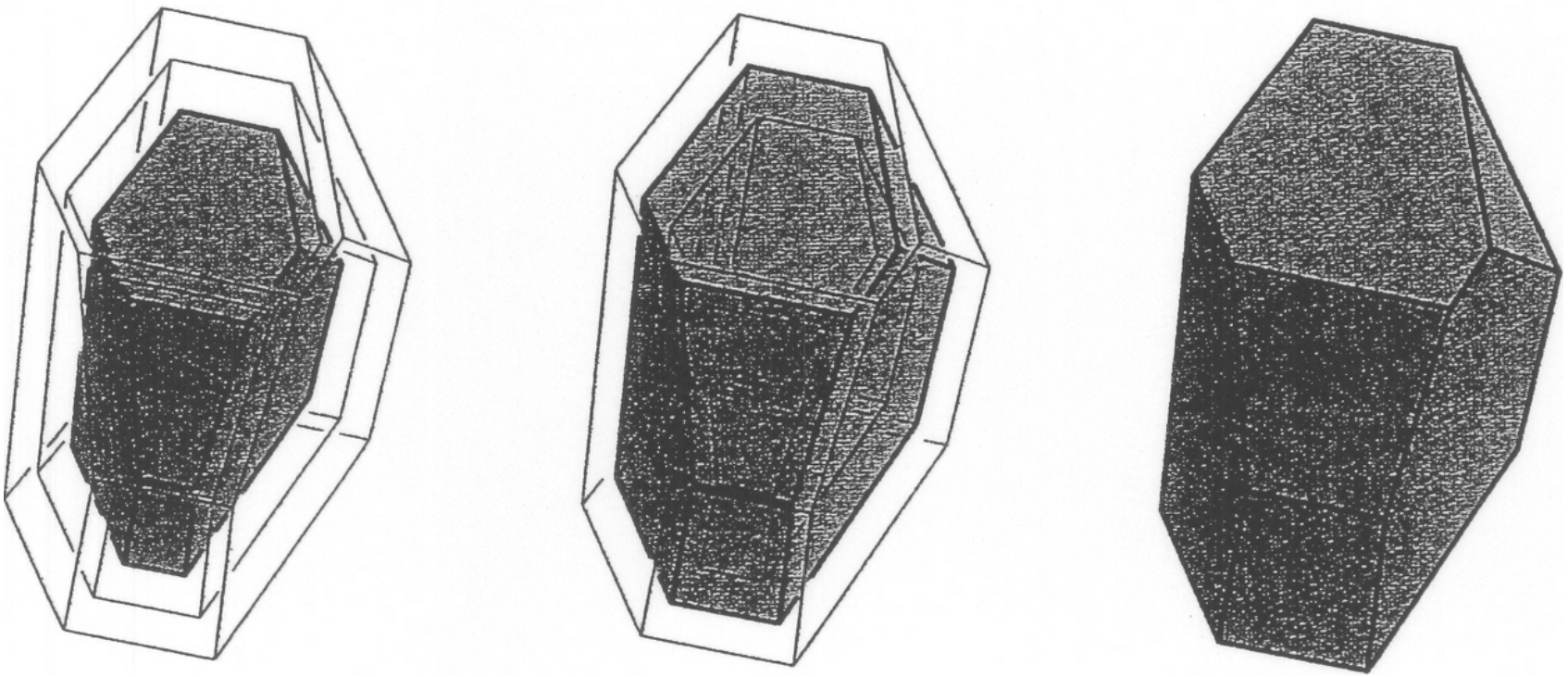




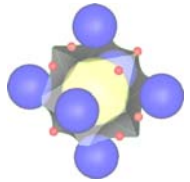
Discrete offset of planar polygons



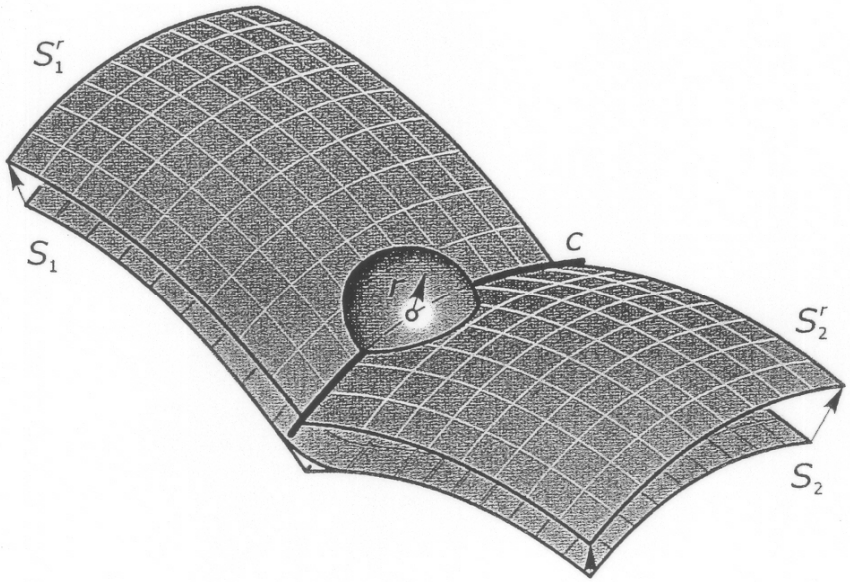
Discrete offset of polyhedral surfaces

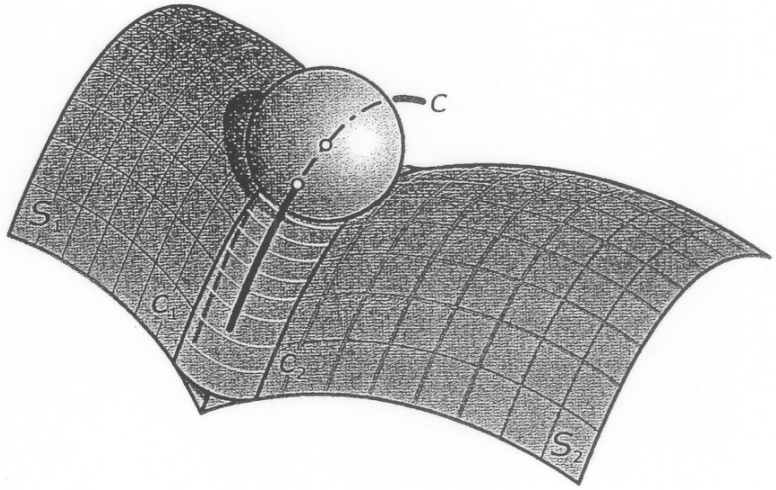


Rolling ball blends

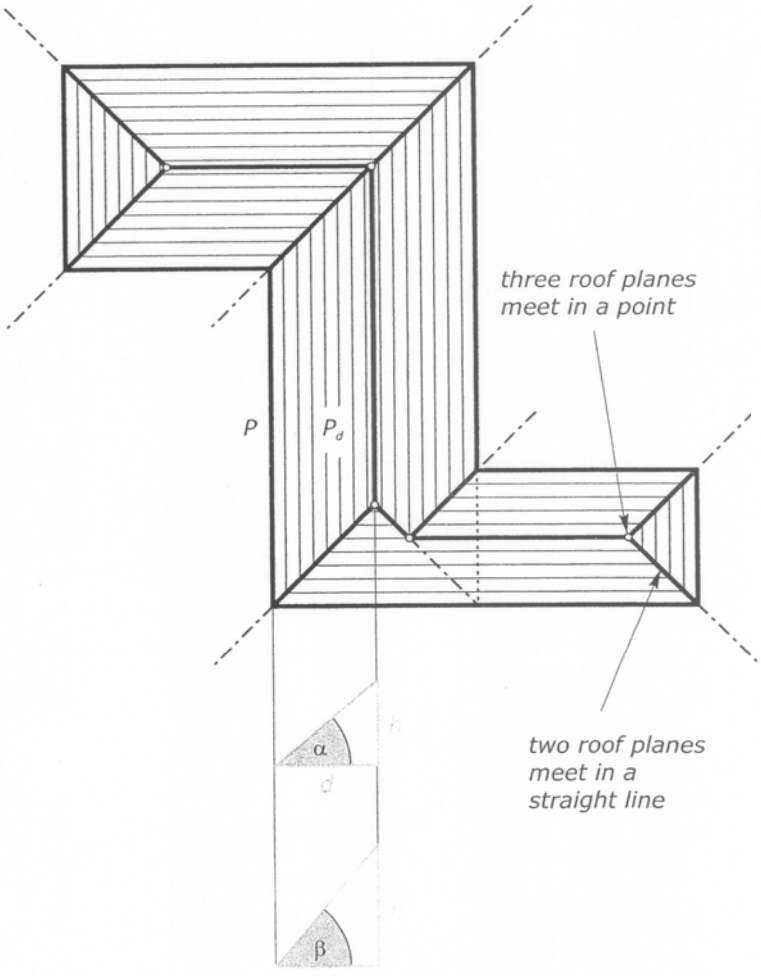


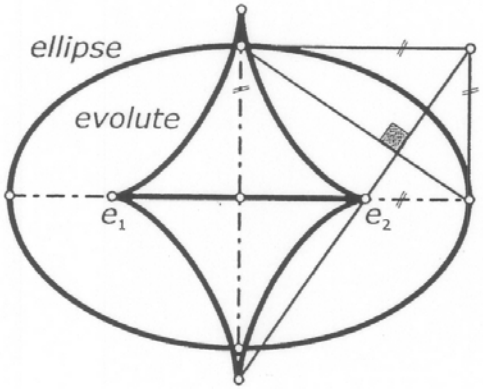
- The intersection between offset surfaces
- Piped surface defined by the central curve via the intersection

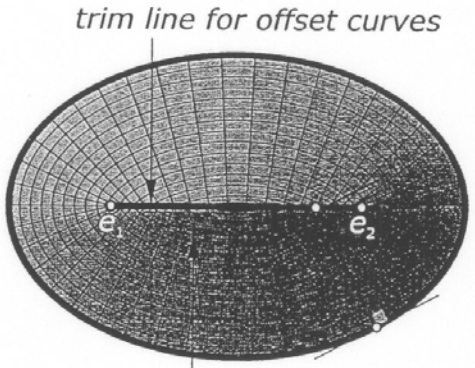




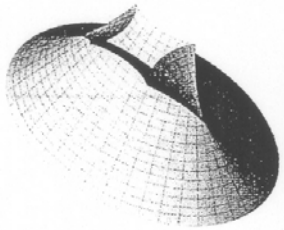
Geometric roof design

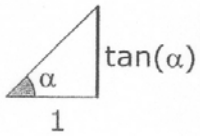


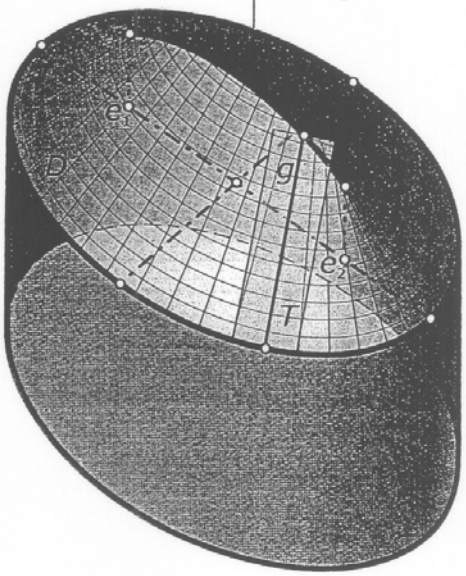




trimmed offsets of eaves curve are top views of roof iso-height contour lines







Geometric roof design