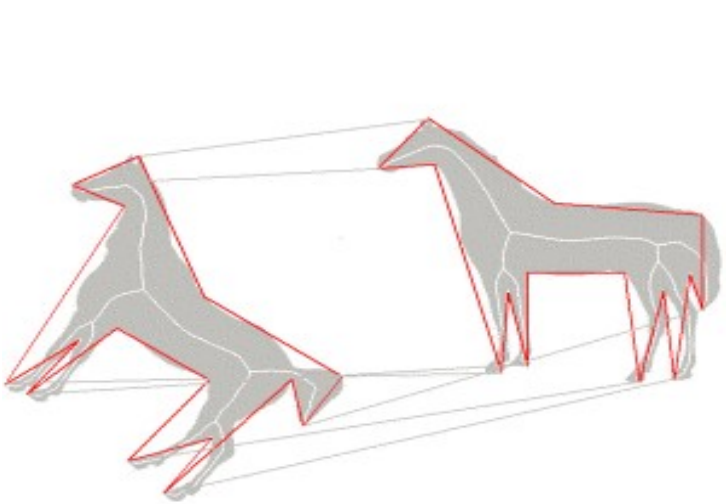
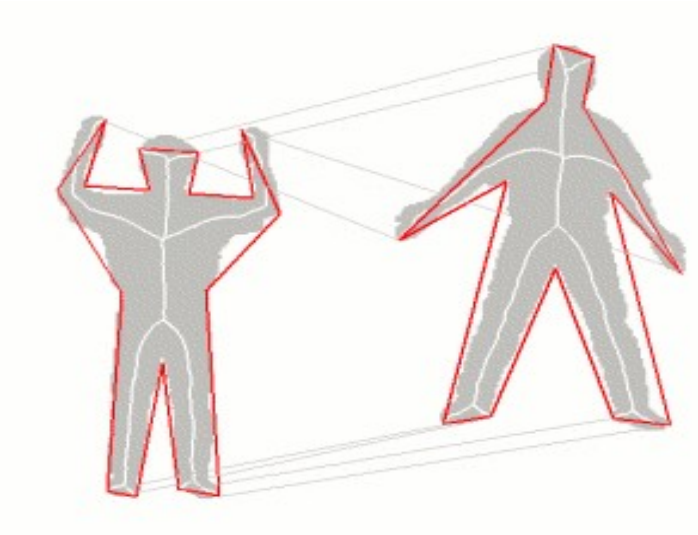
IA841 – Modelagem de Sólidos

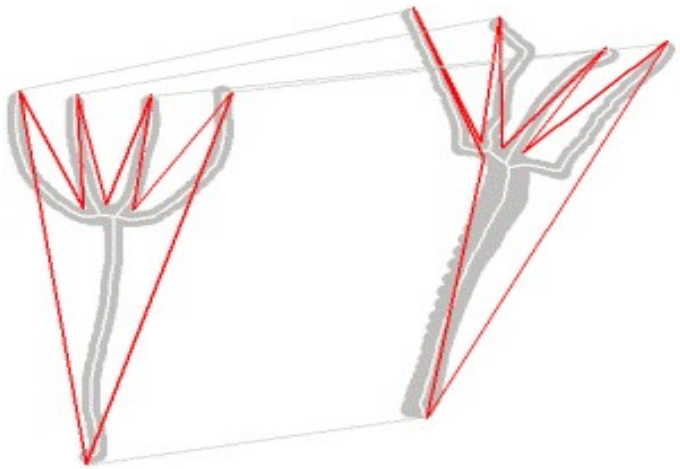
Avaliação dos Modelos

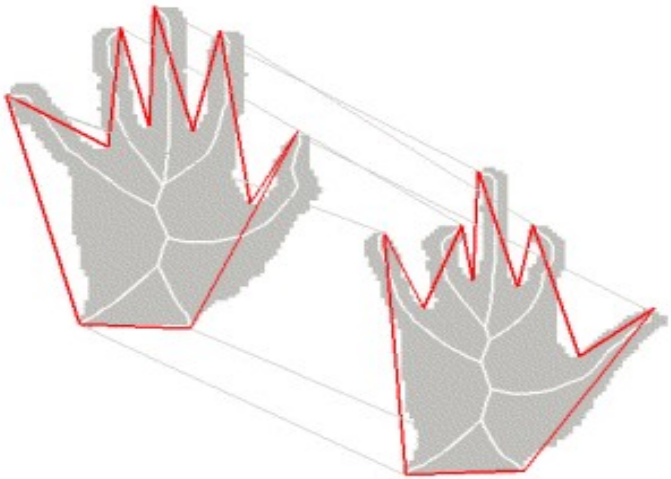
Farin: Capítulo 23

Similaridade





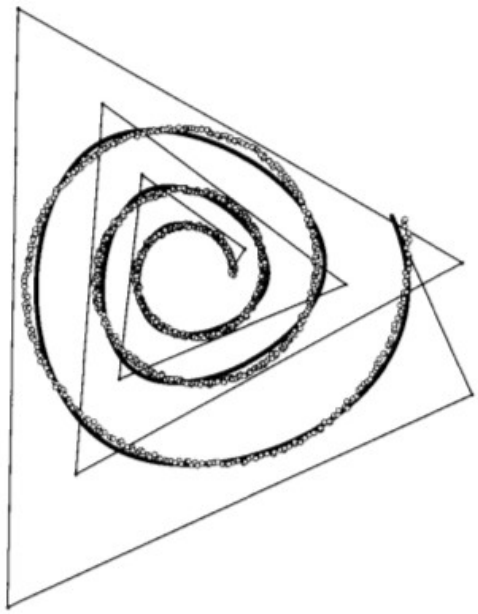




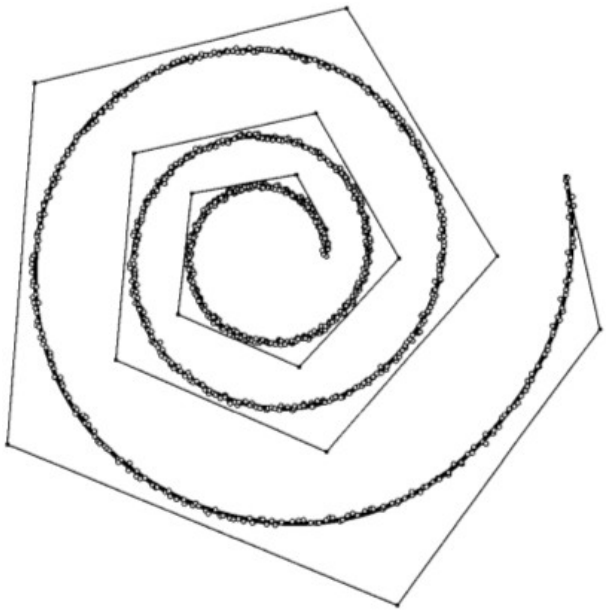
http://www.dabi.temple.edu/~shape/partshape/structure/4.php

Gráficos de Curvatura

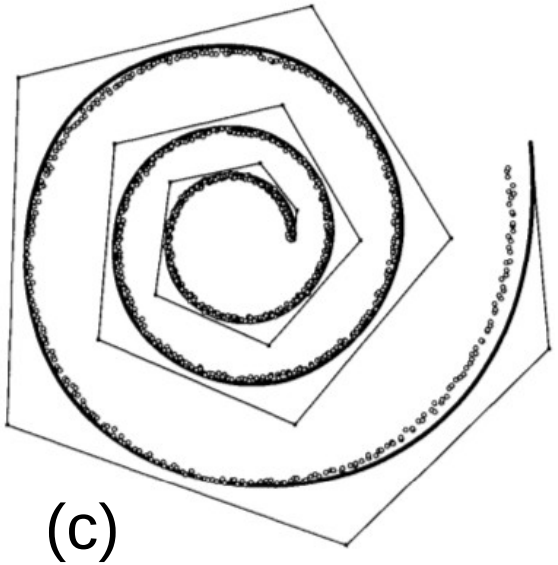
$$\kappa(u)=\frac{\ddot{x}(u)\,\dot{y}(u)-\ddot{y}(u)\,\dot{x}(u)}{[\dot{x}^2(u)+\dot{y}^2(u)]^{3/2}}$$



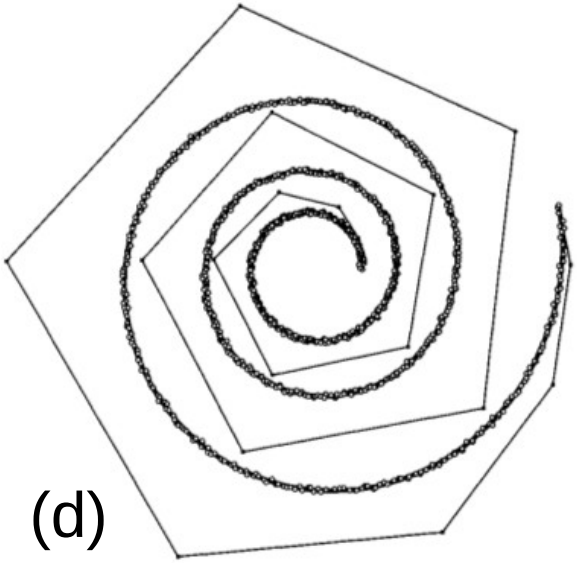
(a)



(b)

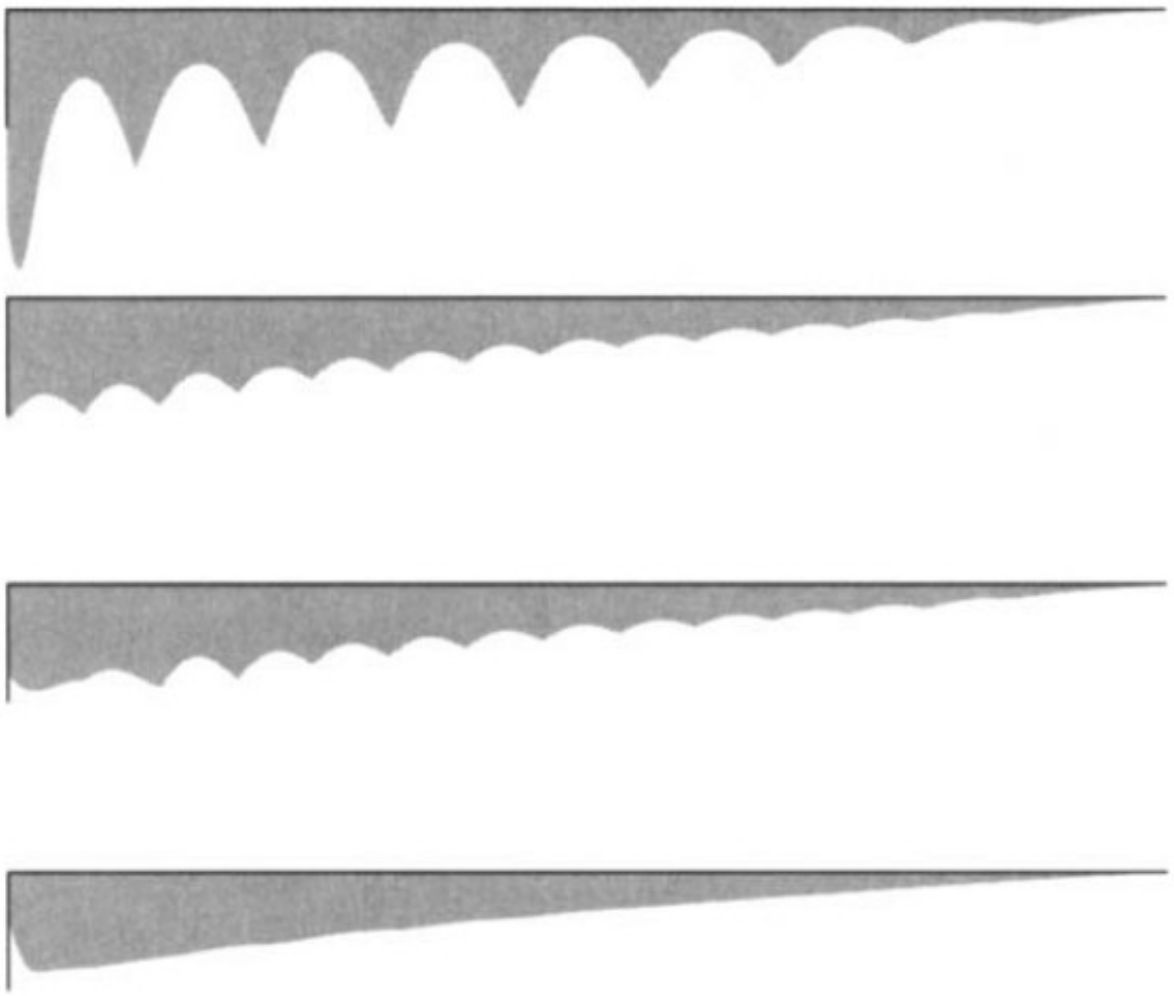


(c)



(d)

Gráficos de Curvatura ($\tau = 0$)



(a)

(b)

(c)

(d)

“*Fairness*”

We now go one step further and use curvature plots for the definition of fair curves: *a curve is fair if its curvature plot is continuous and consists of only a few monotone pieces.*[2] Regions of monotone curvature are separated by points of extreme curvature. The number of curvature extrema of a fair curve should thus be small—curvature extrema should occur only where explicitly desired by the designer, and nowhere else!

Extraído do livro CAGD, Farin

Derivada de Curvatura

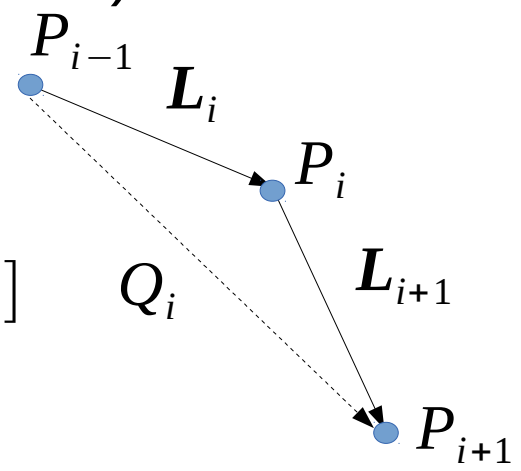
- Variação abrupta na curvatura → curva pouco suave

$$\frac{d\kappa}{ds} = \frac{det[\dot{\boldsymbol{x}}, \dddot{\boldsymbol{x}}]}{\|\dot{\boldsymbol{x}}\|^4} - 3\,\dot{\boldsymbol{x}}\,\ddot{\boldsymbol{x}}\,\frac{det[\dot{\boldsymbol{x}}, \dddot{\boldsymbol{x}}]}{\|\dot{\boldsymbol{x}}\|^6}$$

- Uma aproximação para amostra (plana) *i*:

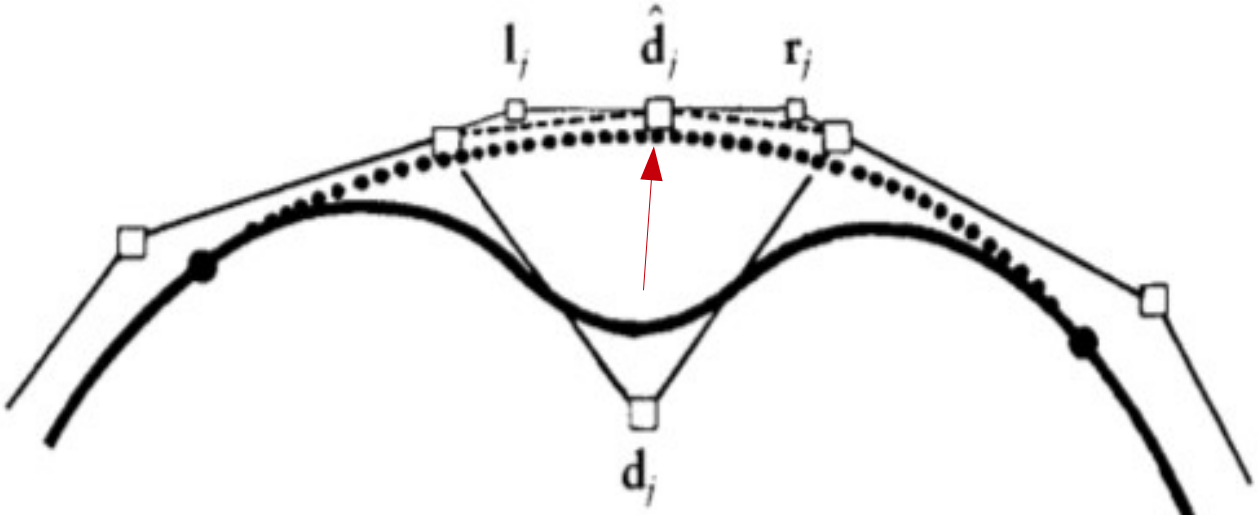
$$\kappa_i = \frac{4\,\Delta_i}{|L_i||L_{i+1}||Q_i|}$$

$$\Delta_i = \frac{1}{2}\,det[\boldsymbol{L}_i, \boldsymbol{L}_{i+1}]$$

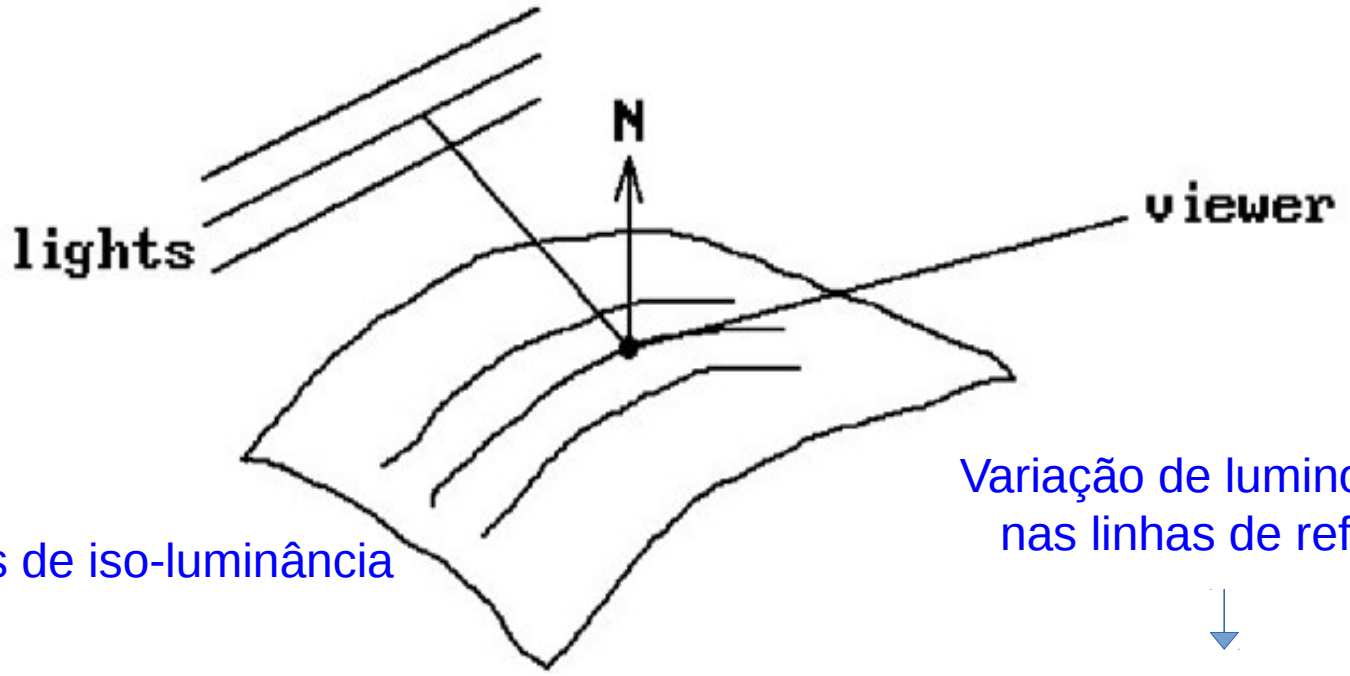


$$D^2\,\kappa_i = \frac{\kappa_{i+1} - \kappa_i}{|\boldsymbol{L}_{i+1}|} - \frac{\kappa_i - \kappa_{i-1}}{|\boldsymbol{L}_i|}$$

Suavização



Suavidade



Curvas de iso-luminância

Variação de luminosidade nas linhas de reflexão

↓

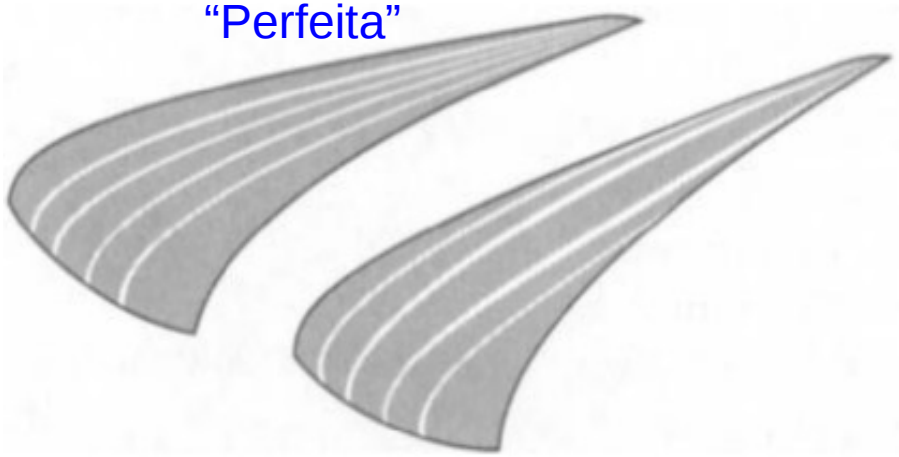
Imperfeições na superfície

http://what-when-how.com/computer-graphics-and-geometric-modeling/surfaces-in-computer-graphics-geometric-modeling-part-8/

Avaliação da carroceria

Fonte de linha de luz fluorescente

"Perfeita"



com imperfeições

Quantificadores

- Curvatura Gaussiana

$$K = \kappa_1 \kappa_2$$

- Curvatura Média

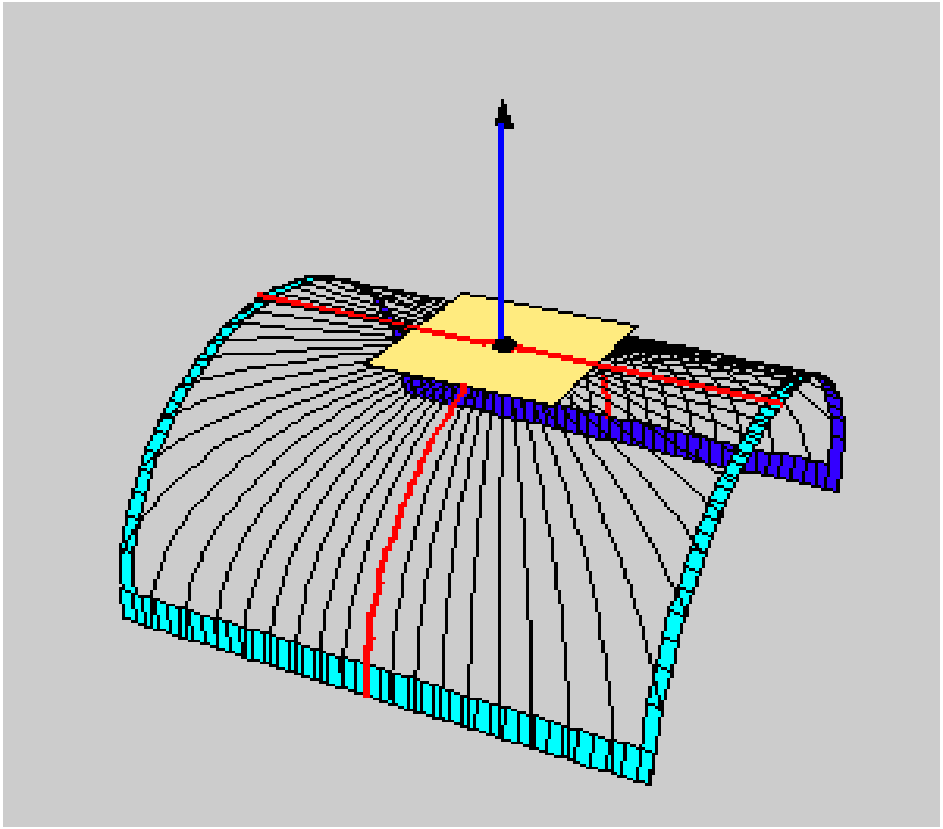
$$H = \frac{\kappa_1 + \kappa_2}{2}$$

- Curvatura Absoluta

$$\kappa_A = |\kappa_1| + |\kappa_2|$$

Superfícies com pontos parabólicos

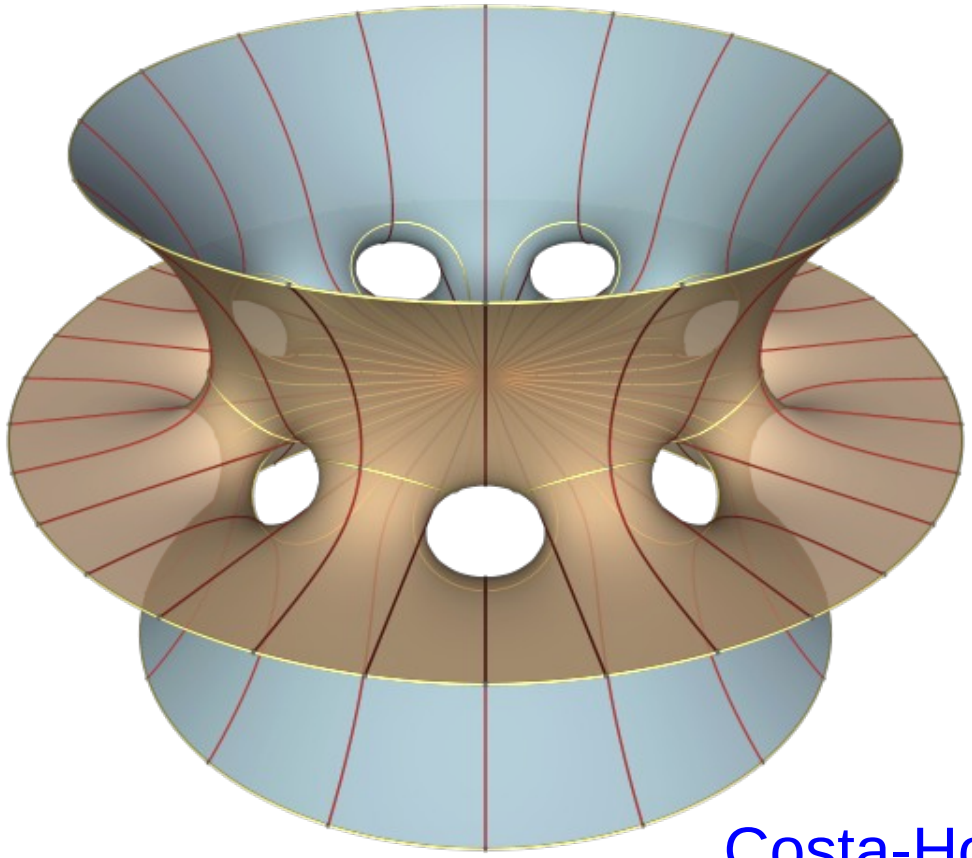
$K = 0$



http://www.grad.hr/itproject_math/Links/sonja/gausseng/ehpp/ehpp.html

Superfícies Mínimas

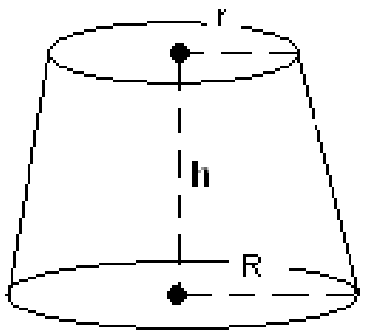
$H = 0$



Costa-Hoffman-Meeks II

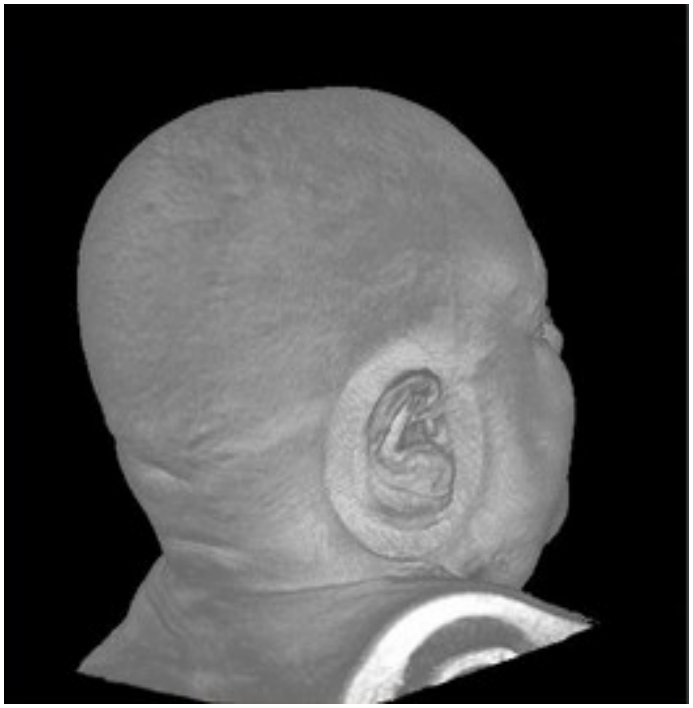
http://www.indiana.edu/~minimal/archive/

Medidas



$$\text{Area} = \pi(R + r)\sqrt{(R - r)^2 + h^2}$$

$$\text{Volume} = \frac{\pi}{3}h(R^2 + r^2 + R * r)$$

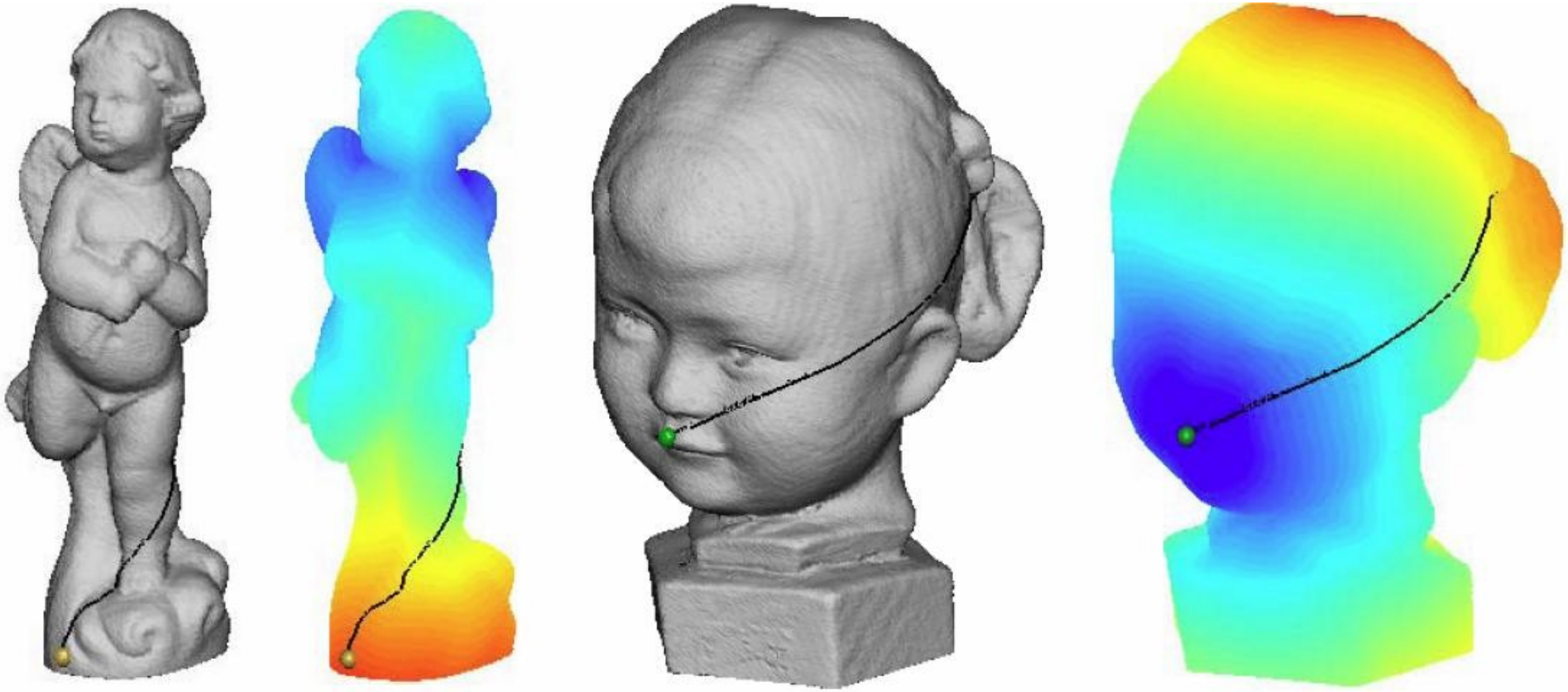


Como obter as medidas?

http://www.ncbi.nlm.nih.gov/pubmed/1584141

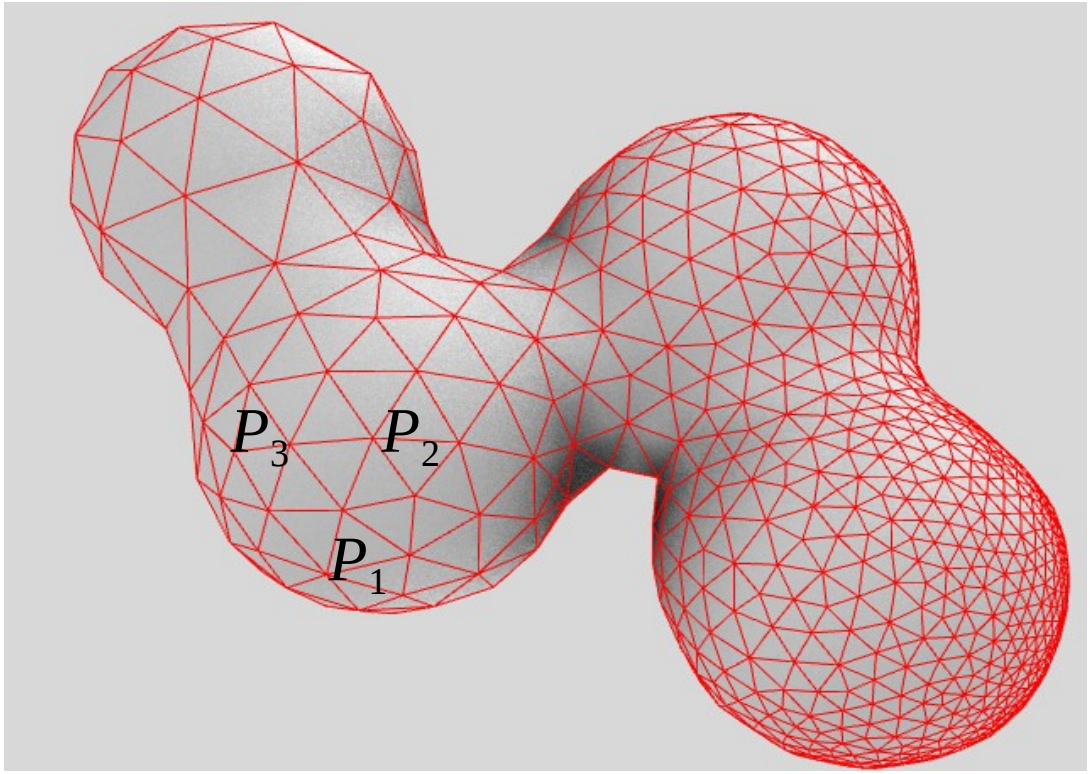
Geodésica

Curva de menor caminho entre dois pontos sobre uma superfície.



http://cg.cs.tsinghua.edu.cn/research_archive.htm

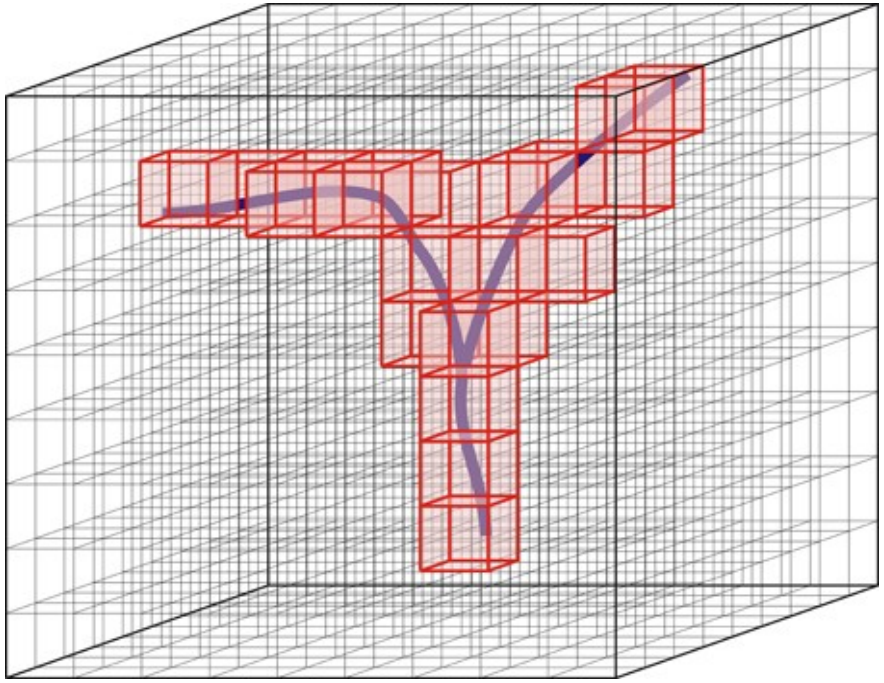
Estimativa de Área



$$A_i = \frac{1}{2}\left|\left(P_2 - P_1\right) \times \left(P_3 - P1\right)\right|$$

$$A \approx \sum A_i$$

Estimativa de Volume



$$V_i = c_i \cdot l_i \cdot h_i$$

$$V \approx \sum V_i$$