

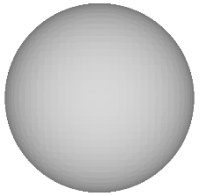
3D Scanning & Motion Capture

Exercise - 2

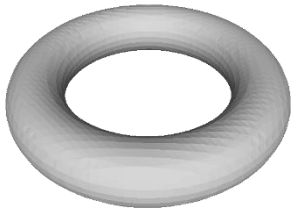
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Implicit Functions – Sphere / Torus



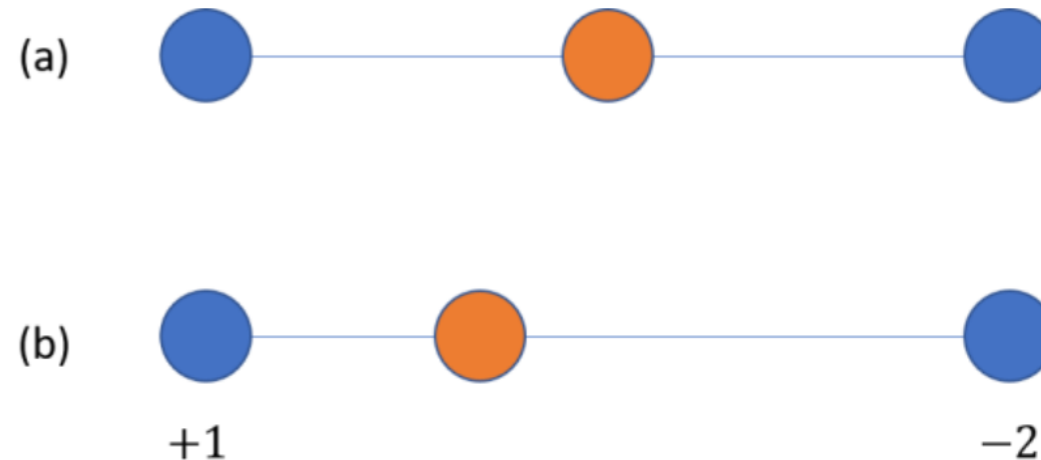
$$f(x, y, z) = x^2 + y^2 + z^2 - R^2$$



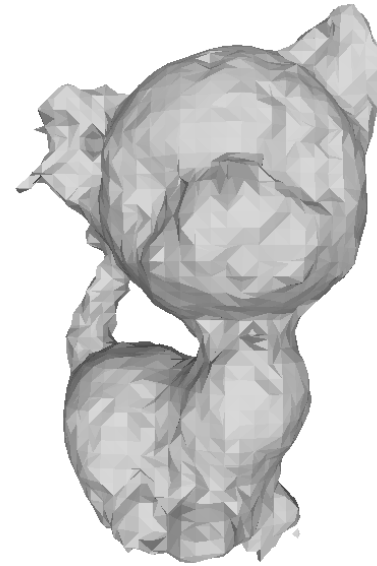
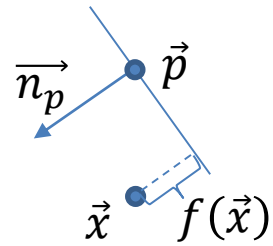
$$f(x, y, z) = (x^2 + y^2 + z^2 + R^2 - a^2)^2 - 4R^2(x^2 + y^2)$$

Linear Interpolation

- Your task is to compute the linear interpolated point using the provided distances.
 - (a) shows the basic implementation
 - (b) shows an example with *isolevel* = 0, *valp1* = +1 and *valp2* = -2 .



Implicit Functions – Hoppe

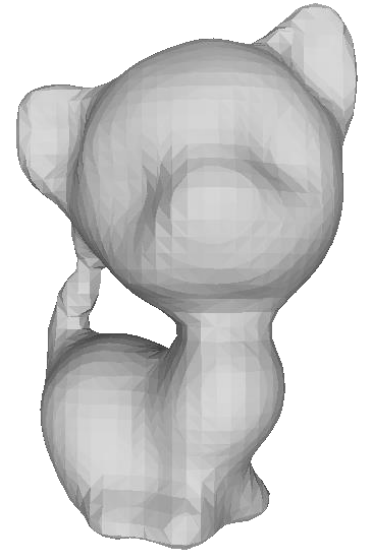


Implicit Functions – RBF

$$f(\vec{x}) = \sum_i \alpha_i \cdot \|\vec{p}_i - \vec{x}\|^3 + \vec{b} \cdot \vec{x} + d$$

$$\begin{array}{l}
 \text{on surface points} \\
 \text{off surface points}
 \end{array}
 \left[\begin{array}{ccccccc}
 \varphi_{1,1} & \cdots & \varphi_{1,n} & p_{1,x} & p_{1,y} & p_{1,z} & 1 \\
 \vdots & \ddots & \vdots & \vdots & \vdots & \vdots & \vdots \\
 \varphi_{n,1} & \cdots & \varphi_{n,n} & p_{n,x} & p_{n,y} & p_{n,z} & 1 \\
 \varphi_{n+1,1} & \cdots & \varphi_{n+1,n} & p_{n+1,x} & p_{n+1,y} & p_{n+1,z} & 1 \\
 \vdots & \ddots & \vdots & \vdots & \vdots & \vdots & \vdots \\
 \varphi_{2 \cdot n,1} & \cdots & \varphi_{2 \cdot n,n} & p_{2 \cdot n,x} & p_{2 \cdot n,y} & p_{2 \cdot n,z} & 1
 \end{array} \right] \cdot \begin{bmatrix} \alpha_1 \\ \vdots \\ \alpha_n \\ b_1 \\ b_2 \\ b_3 \\ d \end{bmatrix} = \begin{bmatrix} h_1 \\ \vdots \\ h_{2 \cdot n} \end{bmatrix}$$

$$\underbrace{\quad}_{A} \cdot \underbrace{\vec{x}}_{\vec{x}} = \underbrace{\vec{b}}_{\vec{b}}$$



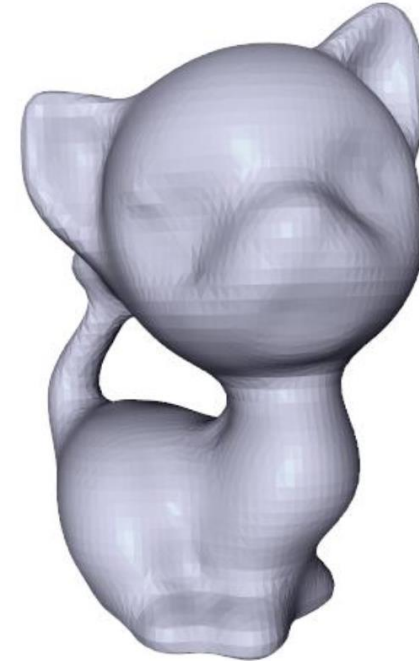
Implicit Functions



Input Points



Hoppe



RBF