3D Scanning & Motion Capture

Exercise - 2

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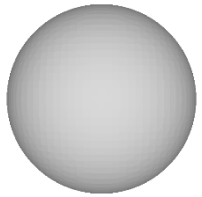
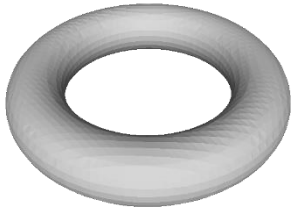
Implicit Functions – Sphere / Torus



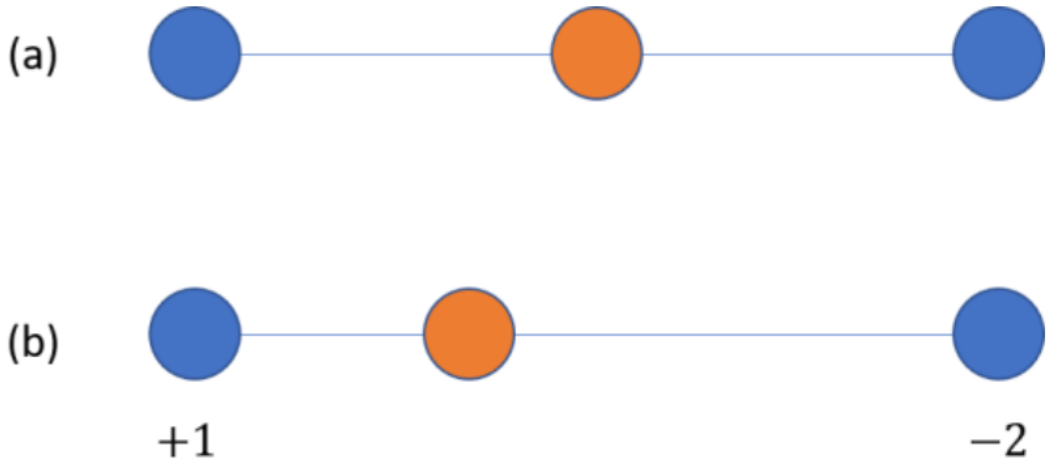
$$f(x,y,z) = x^2 + y^2 + z^2 - R^2$$



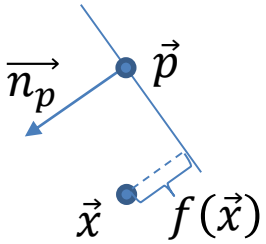
$$f(x,y,z) = (x^2 + y^2 + z^2 + R^2 - a^2)^2 - 4R^2(x^2 + y^2)$$

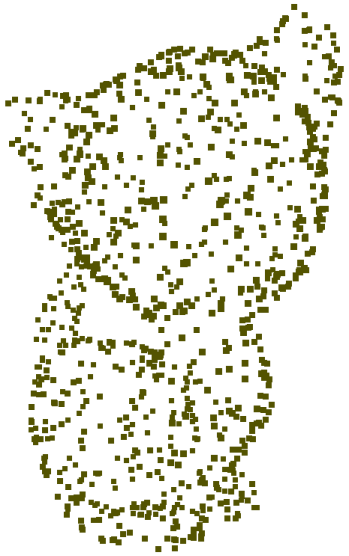
Linear Interpolation

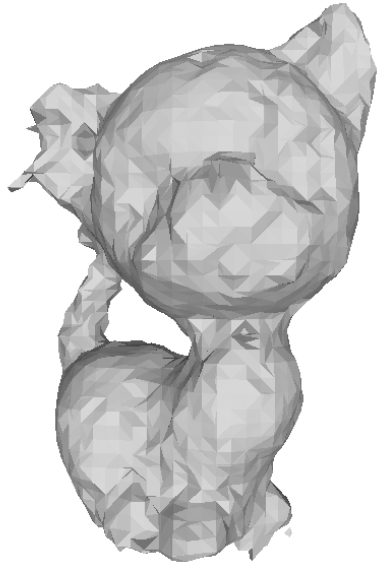
- Your task is to compute the linear interpolated point using the provided distances.
  - (a) shows the basic implementation
  - (b) shows an example with *isolevel* = 0, *valp1* = +1 and *valp2* = −2 .



Implicit Functions – Hoppe







Implicit Functions – RBF

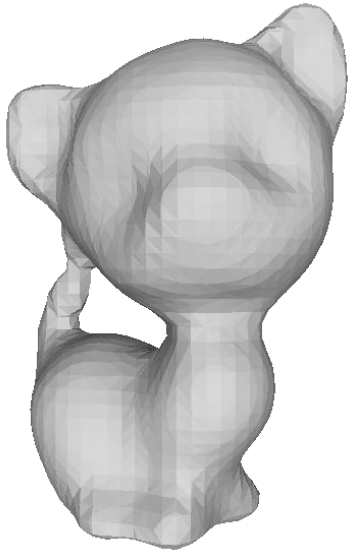
$$f(\vec{x}) = \sum_i \boldsymbol{\alpha_i} \cdot \|\vec{p_i} - \vec{x}\|^3 + \vec{\mathbf{b}} \cdot \vec{x} + \boldsymbol{d}$$

on surface points

off surface points

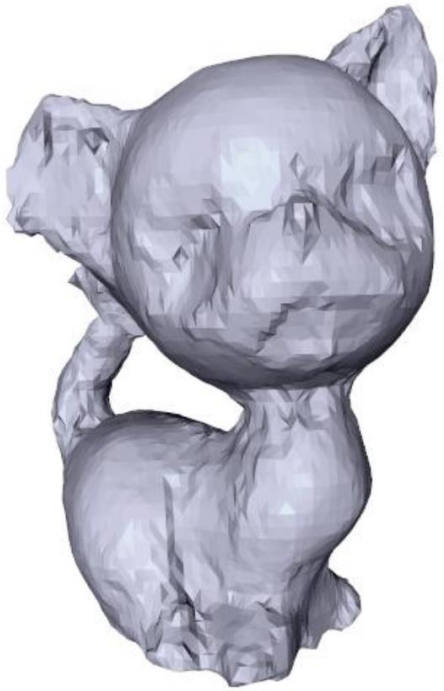
$$\begin{bmatrix} \varphi_{1,1} & \cdots & \varphi_{1,n} & p_{1,x} & p_{1,y} & p_{1,z} & 1 \\ \vdots & \ddots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \varphi_{n,1} & \cdots & \varphi_{n,n} & p_{n,x} & p_{n,y} & p_{n,z} & 1 \\ \varphi_{n+1,1} & \cdots & \varphi_{n+1,n} & p_{n+1,x} & p_{n+1,y} & p_{n+1,z} & 1 \\ \vdots & \ddots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \varphi_{2\cdot n,1} & \cdots & \varphi_{2\cdot n,n} & p_{2\cdot n,x} & p_{2\cdot n,y} & p_{2\cdot n,z} & 1 \end{bmatrix} \cdot \begin{bmatrix} \alpha_1 \\ \vdots \\ \alpha_n \\ b_1 \\ b_2 \\ b_3 \\ d \end{bmatrix} = \begin{bmatrix} h_1 \\ \vdots \\ h_{2\cdot n} \end{bmatrix}$$

$$A \qquad \cdot \vec{x} = \vec{b}$$

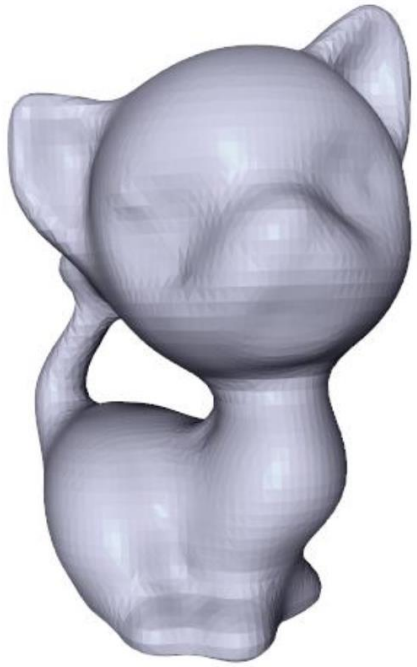


Implicit Functions

Input Points



Hoppe



RBF