Master Project - Real Time Rendering of skeletal structures - Notes on Implicit Surfaces Raytracing

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February 14, 2011

1 Metaballs

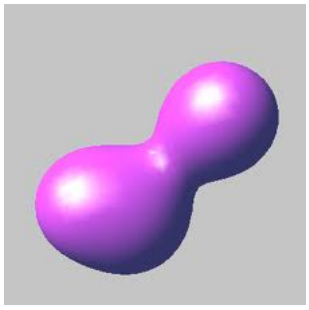

Figure 1.1: MetaBalls

Metaball defined by $p_i, R_i, f_i, suchas, f_i(\|x - p_i\|) = 0, \|x - p_i\| < R_i$. Interested in the surface defined by $f(x) = sigma(q_i f_i(\|x - p_i\|)) - T = 0$. First model Blinn's blob f_i Gaussian function, other with compact support, piecewise quadratic, quartic, degree-six polynomials.

Method to taytrace, solve $f(x) = 0$ along the ray. Example solve methods Bezier clipping, piecewise cubic Hermite polynomials.

2 Metaballs Ray Casting on the GPU

Real-Time GPU Rendering of Piecewise Algebraic Surfaces [BLINN], raytraces algebraic surfacesdefined by Bezier tetrahedra. GPU-based Fast Ray Casting for a Large Number of Metaballs, Yoshihiro Kanamori, Zoltan Szego and Tomoyuki Nishita, converts metaballs to this class of surface, Bezier clipping.

Root finding regula falsi method

3 Ray tracing experiments

3.1 sphere raytracing

Draw a unit cube centred at the origin, pass camera position to shader, save world position (in this case just $gl_Vertex) to the frag$ $rayDir = normalize(worldPos - cameraPos); raytrace from the world position and stop when found a point inside.$

Problems with shading, mess up with space.

Result see figs.

Question world space or screen space to construct the rays? at some point needs inverse transform. Probably better to use a view facing quad.

3.2 one metaball raytracing

improved rootfinding by checking sign alternance. used quadratic metaball function with threshold.