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Rendering piecewise approximations of SDFs through analytic intersections

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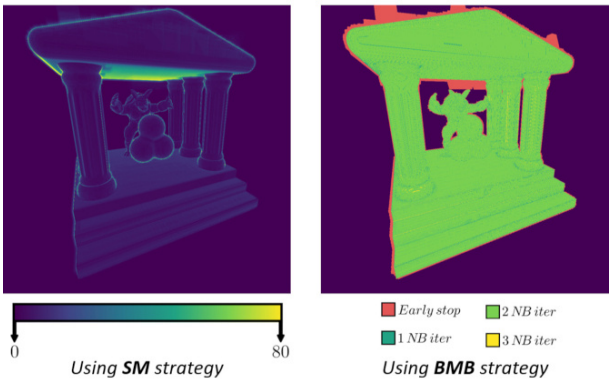

Signed distance fields (SDFs) have emerged as an alternative shape representation for real-time collision detection and lighting effects. Computing these for complex models can be expensive, so one popular approach is to prepare an approximation via sampling and interpolation. Then, these may be rendered using sphere marching, which gets close to the surface quickly, but needs several iterations to converge to it. In this paper, we propose an alternative that computes the intersection of a given ray and the surface analytically at a narrow band. This may be combined with other enhancements like having variable error for the approximation depending on the distance to the surface and skipping regions that do not contain the surface to accelerate the outer band ray traversal while reducing the required memory. To achieve smoother representations with minimal computational cost, we propose a method for computing surface intersections and normals from separate interpolants. We evaluate all these to find the optimal combination improving the rendering performance and memory consumption of these SDF approximations.

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