

Shadow Mapping

Degree programme : BSc in Computer Science | Specialisation : Computer Perception and Virtual Reality
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Shadow Mapping is a popular method to render shadows in 3D computer graphics. Modern rendering engines rely on shadows to give scenes a sense of realism and depth. Shadow Mapping outperforms other shadow rendering techniques in terms of performance making it a solid choice for any realistic real-time 3D computer graphics application.

Introduction

Shadows play an important role in realistic 3D computer graphics. A popular technique to render shadows is Shadow Mapping. Shadow Mapping has been around since 1978 when it got introduced in the paper “Casting curved shadows on curved surfaces.” by Lance Williams. Even with real-time Ray Tracing becoming more viable, Shadow Mapping is still widely used.

How it works

The basic principle of Shadow Mapping is that scenes get rendered from the point of view of lights which cast shadows. The results of these Rendering Passes get saved in Depth Maps. The information saved in these Depth Maps is used when the final scene gets rendered. A pixel is in shadow when its distance to the light is greater than the corresponding value saved in the Depth Map.

Depending on the type of light different projection matrices get used to render the Depth Maps. Directional lights use orthographic projection matrices and

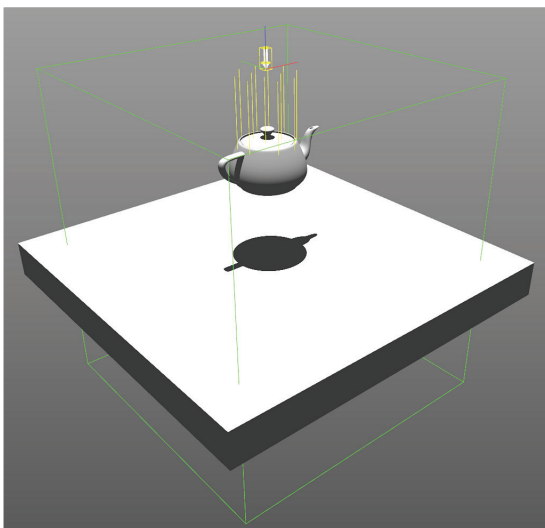
spotlights use a perspective projection matrices. To create the Depth Map of a point light, the scene has to get rendered six times, once in every direction.

Results

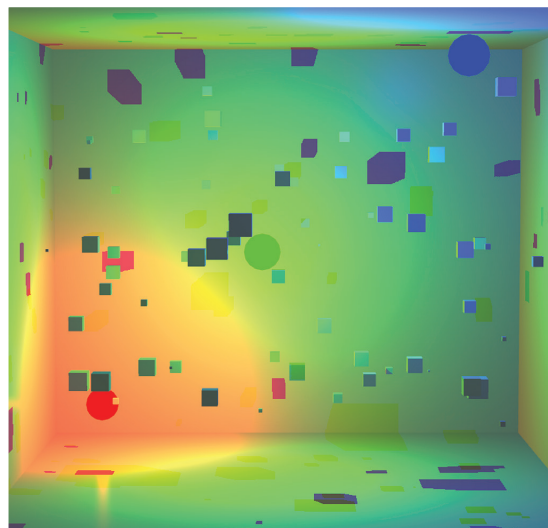
Shadow Mapping got implemented in the SLProject framework. All light types are supported. This includes directional lights, spotlights, and point lights. Controls to configure properties of the Shadow Maps were added to the SLProject demo application. Additionally, some visualizations were added. When a light source is selected its view frustum gets drawn and rays hitting a surface get sampled from its Depth Map. The written code is licensed under GPLv3 and is available on <https://github.com/cpvrlab/SLProject/>.



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Teapot casting a shadow



Scene with three point lights