Master's Thesis Pre-Proposal: Enhance Interactive Subsurface Scattering Toward Off-line Quality

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Translucency is an important feature for material perception. Bidirectional subsurface scattering reflectance distribution function, BSSRDF, is the most common way to describe subsurface scattering. Since there is no analytical solution for it yet, numerical approximation is needed. Jensen etc.[3] proposed an diffusion approximation for it. It is comprised of one diffusion approximation and one single scattering term to complete their model. This model is a very successful one and then becomes widely used in rendering translucent material. Unfortunately, that is still a computationally expensive rendering process.

In this decade, graphical hardware has been improved a lot. Accordingly, several parallel implementations have been proposed to exploit GPU processing power[1][6][4]. Because of the nature of GPU architecture design, it is difficult to re-implement algorithm on GPU. As a result, most of those implementations have some limitations. For example, Mertens etc.[4] are only eligible for rigid object. Shah etc.'s[5] is the one with least limitations for now. By calculating irradiance from light view and integrating subsurface scattering from camera view, it is capable to render back lit effect, flexible view angle, flexible light source, and deformable object, but it still suffers from using only one point light source.

Studying how humans perceive translucency and transparency and how to exploit it to benefit rendering process is a popular topic now. As Fleming etc.[2] suggest, human perception of translucent material is based on glossiness, highlight, light direction, and color. The work of Shah etc.[5] does not address human perception. We argue that we can enhance Shah etc.'s work by amending the irradiance gathering method and generating specular highlight to get a better result from the aspect of perception.

This study will mainly focus on enhancing Shah's work and comparing the result with Jensen's off-line renderer. It will use the similar method presented in Fleming's work[2] to compare the differences between final result with off-line renderer. It will also compare how three BSSRDF parameters influence the difference between interactive and off-line rendering. Eventually, it will suggest if interactive subsurface scattering rendering is mature enough to replace off-line rendering. If not, it will give reasons why and how to make it better.

References

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