

Realistic Rendering of Surface Appearance Using GPU

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We present techniques for realistic modeling surface details and efficient rendering of the associated visual effects using programmable GPUs. An important topic in rendering surface appearance is the treatment of mesostructures, which are responsible for fine-scale shadowing, occlusion, inter-reflectance, and silhouettes. One way to model surface mesostructure is by using the bi-directional texture function (BTF), a 6D function that describes the appearance of a real-world surface as a function of lighting and viewing directions. We describe algorithms for efficient synthesis of BTFs on arbitrary surfaces and for hardware-accelerated rendering. Because the BTF can be measured from real-world surfaces, these algorithms allow us to texture 3D models with real-world textures. One issue with the BTF-based approach is that silhouettes of surface mesostructures are absent in the rendered images. This problem can be addressed by view-dependent displacement mapping, a technique for real-time rendering of displacement mapped surfaces using GPUs. We will present examples of our techniques shipped with major game platforms and some upcoming game titles.