

CS667 Homework 2

(due 18 September)

Implement a microfacet BRDF following Walter et al. [1]. Break out the microsurface normal distribution D and the shadowing–masking function G as separate functions that can be swapped for different surface models. You can do this in whatever environment you like; I might use MATLAB.

1. Can you implement Cook & Torrance’s model in your framework exactly? If so, give the expressions for D and G you would use; if not, explain the difference.
2. For a plastic surface with roughness $\alpha_m = 0.1$ and refractive index $n = 1.5$, plot the BRDF using Beckman’s normal distribution and Smith’s shadowing–masking function. Plot f_r as a function of exitant angle for fixed incident angles at 10 degree increments. Make polar, Cartesian, and semilogarithmic plots. Mark the specular direction to illustrate off-specular reflection. To facilitate comparison between the different angles, overlay multiple plots on the same graph as much as you can while maintaining legibility.
3. Choose two incident angles and make plots illustrating the breakdown of the BRDF into the F , D , G , $d\omega_m/d\omega_o$, and cosine factors. Choose the type and arrangement of plots to clearly illustrate how these factors interact to produce the behavior observed in the BRDF.

Choose the domain and range of your graphs to ensure that the interesting features of the functions you are plotting are visible. This may mean splitting up the plots, plotting different parts with different scales, etc. Please don’t give me plots with everything squished at the bottom of the graph or going off the scale at the top! Think of creating a legible, clear, and attractive presentation of the data as an important part of the assignment [2].

Hints: Note that I’m asking for a BRDF, not a BTDF; don’t get distracted by the paper’s focus on transmission. Watch out for the unusual $\chi+$ notation.

Reference

- [1] Bruce Walter, Stephen R. Marschner, Hongsong Li, and Kenneth E. Torrance. “Microfacet Models for Refraction through Rough Surfaces.” In proceedings of *Eurographics Symposium on Rendering 2007*.
- [2] Edward Tufte. *The Visual Display of Quantitative Information*, 2e. Graphics Press, 2001.