Worksheet 11

Given optical properties as input, you should be able to render a homogeneous participating medium or a translucent material in realistic surroundings. The next step is to acquire optical properties that accurately capture the appearance of real-world materials. The assignment in this area will be open-ended. Creativity is encouraged.

Learning Objectives

- Combine shading and tracing techniques with theory for light-material interaction.
- Analyse real-world light-material interaction and propose ways of simulating it.

Appearance Modelling

During the course, we have identified some of the key optical properties needed for physically based modelling of different types of materials and visible phenomena. The following is a short summary of these optical properties and the uses that we have discussed.

- The complex refractive index is useful for rendering smooth metal surfaces, transparent and coloured glasses and liquids as well as dispersion of light.
- The BRDF is useful for rendering opaque materials that exhibit diffuse, rough, or glossy reflection of light. This could be materials such as metallic paints, brushed steel, and wood.
- Scattering properties are useful for rendering volumes and translucent materials such as milk, skin, porcelain, and plants. They capture the scattering of light by particles under the surface of an object.

The assignment is now as follows.

- Go outside the lab and find a material or visible phenomenon that you would like to model. Take (or find) a photograph of whatever you choose.
- Write down what type of rendering method and optical properties you would need to render the appearance of the chosen material or phenomenon.
- Search the literature to see if the needed optical properties are available, and to see if a rendering method already exists. Write down references and a short description of the literature you found.
- Describe how you would do the rendering using the methods covered in this course. Include in the description any difficulties and extensions of the framework that might be necessary. Although it is not required, feel free to do experimental renderings of the material or phenomenon that you have chosen.

Worksheet 11 Deliverables

A description of how you would render the appearance of a material or a visible phenomenon that exists in the real world. Please include a photograph of the chosen material or phenomenon as well as any optical properties that you might find in the literature, and give references.

Reading Material

The curriculum for Worksheet 11 is

- Frisvad, J. R., Christensen, N. J., and Jensen, H. W. Computing the scattering properties of participating media using Lorenz-Mie theory. ACM Transactions on Graphics (Proceedings of ACM SIGGRAPH 2007) 26(3), pp. 60:1-60:10, 2007.
- Dal Corso, A., Frisvad, J. R., Kjeldsen, T. K., and Bærentzen, J. A. Interactive appearance prediction for cloudy beverages. In Workshop on Material Appearance Modeling (MAM2016), pp. 1-4, The Eurographics Association, June 2016.

Additional resources:

- Dorsey, J., and Rushmeier, H. Advanced material appearance modeling. ACM SIGGRAPH 2009 Courses, Article 3. ACM, 2009. http://dl.acm.org.proxy.findit.dtu.dk/citation.cfm?id=1667242
- Refractive Index Database: https://refractiveindex.info/
- McGuire Graphics Data (Meshes): http://graphics.cs.williams.edu/data/meshes.xml