Technical University of Denmark

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**Frisvad, Jeppe Revall**

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## Frisvad, J. R.

### DTU Informatics, Technical University of Denmark, Richard Petersens Plads, Building 321, DK-2800 Kgs. Lyngby, Denmark


This talk has two purposes: firstly to show what the Lorenz-Mie theory has been used for in computer graphics, secondly to discuss the generalisations of the theory that are available and why they are important in a graphics context. Some details are provided in the following.

In order to produce photo-realistic images that capture a digitally modelled scene, we need scattering properties for all the materials that are present in the scene. To acquire such scattering properties, one option is to measure them. Another option is to compute them from the particle contents of the materials. The second option is made possible by the Lorenz-Mie theory, and it provides us with a very flexible way of modelling how the appearance of a material changes when we change its contents. Nevertheless, the Lorenz-Mie theory has only reluctantly been adopted in graphics. In the two papers [1,2] where the theory was first considered for graphics applications, it was found to be either too complicated [1] or too restricted [2] to be useful. The problematic restrictions are that the material should consist of nearly spherical particles embedded in a non-absorbing host medium. This significantly limits the number of materials that can be modelled by the original version of the theory. Even so, the original theory has proven useful for modelling the appearance of some special materials: Callet [3] used the theory to model pigmented materials (such as paints, plastics, inks, and cosmetics which consist of pigmented particles in a transparent solvent). Jackèl and Walter [4] used it to model the atmosphere and rainbows. Nishita and Dobashi [5] used the theory to model various other materials consisting of particles in air (clouds, smoke/gas, fog/haze, snow, and sand). Most recently, we have seen a development towards generalisation of the Lorenz-Mie theory such that it becomes useful for a wider range of materials. These new developments were adapted for graphics by Frisvad et al. [6]. I will discuss this and other generalisations of the theory. Figure 1 exemplifies how we can use the Lorenz-Mie theory to compute the visual significance of each individual component in a material. Of course, we can also use it to compute the appearance of materials with different mixed particle concentrations.

Figure 1: From the paper by Frisvad et al. [6]: Rendered images of the components in milk as well as mixed concentrations. The scattering properties of the components and the milk have been computed using a new scheme for robust evaluation of the Lorenz-Mie coefficients when the host medium is absorbing. From left to right the glasses contain: Pure water, the host medium (water and dissolved vitamin B2), water and protein, water and fat, skimmed milk, regular milk, and whole milk.

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