Interactive Rendering for Effective Visualization of Semi-transparent Particle Models
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Abstract
Particle based modeling and rendering techniques have recently become a promising alternative for high quality visualizing of complex scenes as essential building block for detail rich simulation. Visualization allows clear and concise representations of complex phenomena to aid in the task of sense making.

In this research we study the interactive rendering system for exploration and analysis of complex particle models.

Introduction
Our interactive particle rendering system is a combination of particle rendering engine and high level user interface. One of the main issues in design of such system is providing high level control of the visualization parameters. To create the high quality rendering of particle models, user must interactively analyses a data and specify a parameters with user interface easy to use. Our system objective is to provide an intuitive interface for users with various backgrounds to quickly generate the required results and keep the performance acceptable for the application.

The structure of interactive rendering system
General structure of our system is illustrated in Figure 1.

Rendering system overview
We use our model of a particle rendering engine [1]. It has the following key characteristics and features in comparison with other methods:

- The rendering engine works independently from modelling. Our engine gets different modelling data and converts this data into its own specific format and renders a particle.
- It can render particle models, point clouds and volume data. And it combines all the benefits of these rendering methods.
- In this method we first use a special particle structure for rendering to get a more realistic image.
- We use not only GPU based hardware acceleration, but we also apply a new type of mapping algorithm to achieve fast rendering.

Application interface
The application interface includes three level (analysis, interactive control and parameter generation) communications with rendering engine.

Our system has special user interface module for fine adjustment of all rendering parameters at manageable level. First it gets a summarized data for analyzing a model. Then user can design a transfer functions with different color and opacity values. This module is also used for changing light and texture parameters.

Initial results
To demonstrate the visualization capabilities of our system, we have used a particle model generated by D.Takeshita [2]. And we generated 4 different images with different transfer functions (color and opacity values) and different light color (Figure 2).

Conclusion
In this research we demonstrate initial steps toward realistic and interactive visualization of semi-transparent particle models. The challenge of faithful interactive visualization of complex physically motivated models opens up quite a number of new research directions in classification, interpolation of physical properties of particles, adaptive transparency control and for fully photo-realistic impressions.

References: