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Accelerated Volume Rendering Using Level-Of-Detail Technology

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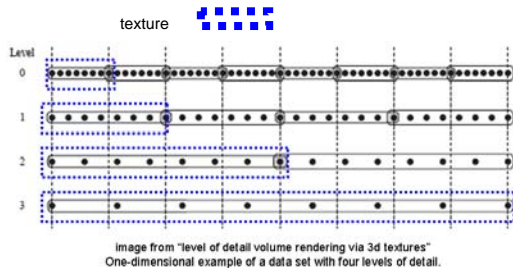
Introduction

Nowadays, more and more virtual manufacturing simulations use volume rendering technology to enhance the display results and effects. When using large volume data sets, normal rendering algorithms trade off image quality against rendering speed. However, it is often not necessary to render the whole data set at some particular observation angles. If the unnecessary data (during a special defined condition) can be edited, the rendering time can be saved and the frame rate can be raised. Similar research aim has been carried out by some world-renowned graphics groups. They have demonstrated that this approach is worthy of additional work.

Project Aims

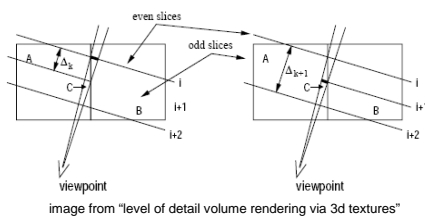
- To analyse and summarize the existing LOD methods. To prepare various information for the future research.
- To make a personal research framework. To design an ideal method to improve effect of volume-based level-of-detail (LOD).
- To build a simple virtual manufacturing environment for future experimentation.
- To use fluid dynamic model to simulate the material loss in a machining process.

Existing method



The key is a "sharing" way:

- One texture is made up of eight points.
- The "eight" is a fixed and the length of texture is variable.
- If we can make every two of them share one texture, the time of rendering works could be saved efficiently.



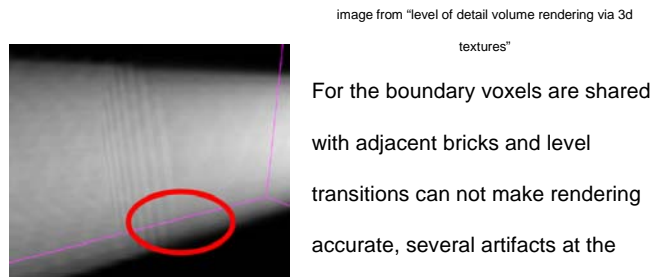
The two pictures figure opacity correction at level transitions for orthographic and perspective views. They depend on whether we look through a brick at the finer level or vice versa.

Results

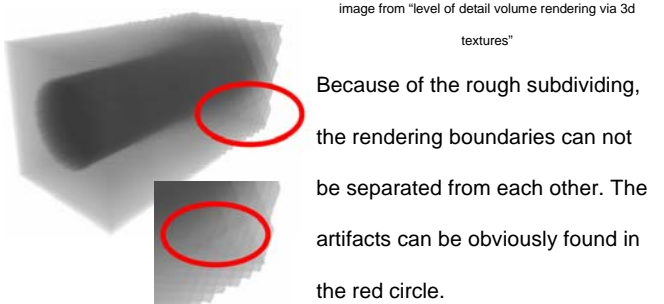


The image from "level of detail volume rendering via 3d textures"
These models are displayed with 100%, 57%, 29% resolution in LOD.

Artifacts



For the boundary voxels are shared with adjacent bricks and level transitions can not make rendering accurate, several artifacts at the brick boundaries (red circle) occur.



Because of the rough subdividing, the rendering boundaries can not be separated from each other. The artifacts can be obviously found in the red circle.

Future Works

- Design a "group" to order the boundaries of different parts of object.
- Develop a simple virtual manufacturing workshop is necessary. The entire programming language is C.
- To take out the artifacts, the new methods will be verified using a frame rate counter.
- The final result should guarantee not only the few artifacts but also a higher frame rate.

switch on to

