GRAPHIC SHADERS FOR SCIENTIFIC VISUALIZATION

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Resumen

Tradicionalmente, la visualización científica se ha realizado en CPUs. Sin embargo, vivimos unos días en los que las GPUs están mejorando drásticamente, por lo que resulta natural una transición de la visualización científica hacia entornos que utilicen las capacidades de paralelización que nos proporcionan las GPUs. En este contexto, los shaders gráficos, introducidos en las tarjetas gráficas y programables, nos aportan capacidades muy interesantes para este ámbito. Así, en este texto se analizan y describen las capacidades de cada uno de los tipos de shaders del pipeline de renderizado aplicadas a técnicas de visualización tradicionales, como transformaciones de imágenes, nubes de puntos para datos escalares 3D, visualización de alturas de terrenos, curvas y superficies de bézier o hedgehog plots para datos vectoriales en 3D.

Palabras clave

Visualización científica, GPU, Shader, Bézier

Abstract

Scientific visualization has traditionally been running on CPUs. However, we live in a time where GPUs are improving at a drastic rate, making a transition toward the parallelization capabilities that GPUs provide seem natural. Within this context, graphic shaders, introduced in graphics cards and programmable, give very interesting features for us to use in scientific visualization. This text analyzes and describes the various properties of each of the shaders in the graphics pipeline, applying them to several well-known scientific visualization techniques. Some of the techniques covered involve image transformation, point cloud for visualizing 3D scalar data, height coloring terrains, bézier curves and surfaces or hedgehog plots for 3D vectorial data.

Keywords

Scientific Visualization, Graphic Shaders, GPU, Bézier

Índice general

Capítulo 1

Title

In this chapter, there will be examples of various features you may want to incorporate into your document. Here's an example of a figure inserted into the text:

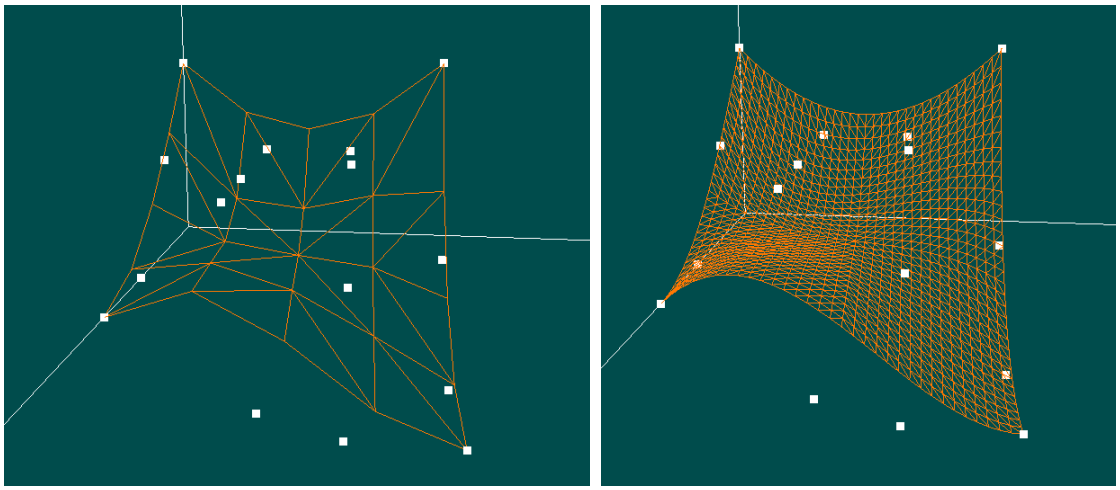

Figura 1.1: *Full caption to appear below the Figure*

Here is an example of a Table:

1.1. Making References to Figures or Tables

In this paragraph, we want to refer to Fig. 1.1 mentioned at the beginning of this chapter. We also refer to the Table 1.1.

Column 1 Heading	Column 2 Heading	Column 3 Heading
Col 1 Row 1	Col 2 Row 1	Col 3 Row 1
Col 1 Row 2	Col 2 Row 2	Col 3 Row 2
Col 1 Row 3	Col 2 Row 3	Col 3 Row 3

Cuadro 1.1: *Caption to appear below the table*

1.2. Making a Reference to a Chapter Subsection

In this section, we refer back to text mentioned in Section 1.1 on page 1.

1.3. Making a Citation

Here's an example of a citation to a single work. Bailey[1] It's also possible to make multiple citations. Bailey[12]

Capítulo 2

This is Chapter 2

In this chapter, I want to refer to Chapter 1, so I'm going to use the slash ref command along with the "makereference"label which I assigned back at the beginning of Chapter 1.

2.1. Page Number References

I should also be able to refer to a specific page number, such as page 1. Of course, I'll need to have a slash label command and a unique name in each section that I want to be able to refer to later in the text.

2.2. Referring to Sections Within Chapter 1

Now, I'm going to refer to different sections within Chapter 1. I gave an example of a figure in section 1.1 and an example of a table in section 1.2. In section 1.3, we looked at examples of bibliographic citations.

Capítulo 3

This is Chapter 3

Here are more examples of referring to previous sections. In Chapter 1 there were several sections, including section 1.1, section 1.2, and section 1.3.

Likewise, in Chapter 2, there are sections 2.1 and 2.2.

Bibliografía

[1] M. Bailey. Using gpu shaders for visualization. *IEEE Computer Graphics and Applications*, 29(35):96–100, 2009.

[2] M. Bailey. Using gpu shaders for visualization ii. *IEEE Computer Graphics and Applications*, 31(2):67–73, 2011.

Apéndice A

Title for This Appendix

Apéndice B

Title for This Appendix