

## Interactive Volume Visualization of General Polyhedral Grids

### This paper appears in:

Visualization and Computer Graphics, IEEE Transactions on

**Date of Publication:** Dec. 2011

**Author(s):** Muigg, P.

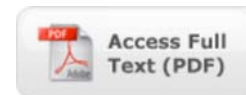
Vienna Univ. of Technol., Vienna, Austria

Hadwiger, M. ; Doleisch, H. ; Groller, E.

**Volume:** 17 , Issue: 12

**Page(s):** 2115 - 2124

**Product Type:** Journals & Magazines



### ABSTRACT

This paper presents a novel framework for visualizing volumetric data specified on complex **polyhedral grids**, without the need to perform any kind of a priori tetrahedralization. These **grids** are composed of polyhedra that often are non-convex and have an arbitrary number of faces, where the faces can be non-planar with an arbitrary number of vertices. The importance of such **grids** in state-of-the-art simulation packages is increasing rapidly. We propose a very compact, face-based data structure for representing such meshes for **visualization**, called two-sided face sequence lists (TSFSL), as well as an algorithm for direct GPU-based ray-casting using this representation. The TSFSL data structure is able to represent the entire mesh topology in a 1D TSFSL data array of face records, which facilitates the use of efficient 1D texture accesses for **visualization**. In order to scale to large data sizes, we employ a mesh decomposition into bricks that can be handled independently, where each brick is then composed of its own TSFSL array. This bricking enables memory savings and performance improvements for large meshes. We illustrate the feasibility of our approach with real-world application results, by visualizing highly complex **polyhedral** data from commercial state-of-the-art simulation packages.

### INDEX TERMS

#### • IEEE Terms

Data **visualization** , Geometry , Graphics processing unit , Rendering (computer graphics)

#### • INSPEC

##### ◦ Controlled Indexing

data structures , data **visualisation** , **interactive** systems , simulation

##### ◦ Non Controlled Indexing

GPU-based ray casting , TSFSL , a priori tetrahedralization , face-based data structure , **general polyhedral grids** , **interactive volume visualization** , simulation packages , two-sided face sequence lists , volumetric data **visualization**

#### • Author Keywords

GPU-based **visualization** . , **Volume** rendering , **polyhedral grids** , unstructured **grids**

Additional Details

References (48)

**Topic(s)** : Bioengineering ; Communication, Networking & Broadcasting ; Computing & Processing (Hardware/Software) ; Fields, Waves & Electromagnetics ; Signal Processing & Analysis

**ISSN** : 1077-2626

**INSPEC Accession Number**: 12359409

**Digital Object Identifier** : 10.1109/TVCG.2011.216

**Date of Current Version** : 03 November 2011

**Issue Date** : Dec. 2011

**Sponsored by** : IEEE Computer Society

**PubMed ID** : 22034330

---

[Sign](#)**IEEE Account**[Change Username/Password](#)[Update Address](#)**Purchase Details**[Payment Options](#)[Order History](#)[Access Purchased Documents](#)**Profile Information**[Communications Preferences](#)[Profession and Education](#)[Technical Interests](#)**Need Help?**[US & Canad](#)[Worldwide:](#)[Contact & Su](#)[About IEEE Xplore](#) [Contact](#) [Help](#) [Terms of Use](#) [Nondiscrimination Policy](#) [Site Map](#) [Privacy & Opting Out of Cookies](#)

A non-profit organization, IEEE is the world's largest professional association for the advancement of technology.

© Copyright 2013 IEEE - All rights reserved. Use of this web site signifies your agreement to the terms and conditions.