Interactive Rendering of Large Unstructured Grids Using Dynamic Level-of-Detail

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Level-Of-Detail Background

► Tetrahedra

- Farias et al. 2000
- Leven et al. 2002
- Cignoni et al. 2004
- Museth and Lombeyda 2004
- Regular Grids
 - Danskin and Hanrahan 1992
 - LaMar et al. 1999
 - Weiler et al. 2000
- Triangles or Points
 - Funkhouser and Séquin 1993
 - Luebke and Erikson 1997
 - Luebke et al. 2002
 - Duessen et al. 2002

Definitions

Given a scalar field $f: D \subseteq \Re^3 \to \Re$ An approximation can be made such that $\left|\overline{f} - f\right| \le \varepsilon$ and $\left|\overline{D}\right| < |D|$. A ray passing through the domain forms a continuous function $g(t) = f(r_0 + tr_d)$





Triangle Sampling Sample the triangles

Boundary + Internal triangles

 $B_1, B_2, \dots, B_n \qquad I_1, I_2, \dots, I_m$

LOD index updated at each pass

 $LOD = \frac{LOD \times TargetTime}{RenderTime}$

LOD







Topology: target continuity





View: target screen-space coverage





Area: target faces that cause greater error











Dataset	Tets	Topology	Field	View	Area
Spx2	0.8 M	17.8 s	4.5 s	5.3 s	13.9 s
Torso	1.0 M	87.2 s	10.5 s	11.6 s	11.2 s
Fighter	1.4 M	75.6 s	13.9 s	15.3s	15.3 s







Domain and Sample Comparison Sample Domain Full Quality 100% @ 20 fps 50% @ 30 fps 50% @ 23 fps $\overline{g}_2(t)$ $\overline{g}_{\eta}(t)$ g(t)

Domain and Sample Comparison Sample Full Quality Domain 100% @ 20 fps 50% @ 30 fps 25% @ 30 fps $\overline{g}_2(t)$ $\overline{g}_{\eta}(t)$ g(t)





- New sampling approach which simplifies LOD
- Well-suited for a GPU implementation
- Dynamic changes to LOD are simple and require no explicit hierarchies

Tetmesh 0.1 code will be available soon at www.sci.utah.edu/~vgc

Open Research

- Better ranking strategies
- Handle even larger data

- Sample the boundaries
- Sample points instead of triangles
- Adaptive time-varying visualization

Acknowledgments

Carlos Scheidegger , Huy Vo, and John Schreiner

Datasets

- Bruno Notrosso (Electricite de France)
- Neely and Batina (NASA)
- SCI Institute, University of Utah
- Funding
 - DOE
 - CNPq
 - MICS
 - NSF
 - University of Utah