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Large-Scale Computation and Visualization

M. Karrenbach[1]

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ABSTRACT

The visualisation facility at the High-Performance Computing Center in Stuttgart offers new possibilities in visualising large 3D and 4D seismic data sets. We explore visual computational steering from within a immersive virtual reality facility.

LARGE-SCALE COMPUTATIONS AND VISUALIZATION

Karlsruhe and Stuttgart University are part of the National Supercomputer Infrastructure which gives access to the High Performance Computer Center located in Stuttgart. Besides a variety of fast large-scale parallel machines, such as Cray T3E, IBM-SP and NEC-SX5, the Computing Center also employs a 3D visualization facility.

This facility is state-of-the-art and uses a CAVE-like environment in which a 3D projection and tracking systems is employed. The environment, termed CUBE, easily accommodates a small group of people. Data to be examined are prepared on a Onyx2 multi-processor system with 3 graphic pipelines, each feeding stereo-scopic images into the projection system. Each viewer has to wear 3D stereo-scopic glasses to give the impression of moving in 3D space.

The movement of one person is tracked and the graphic scene newly computed and displayed at every move. A 3D menu is available and interaction with the display or the computation is possible via moving a 3D mouse over menu bars.

It is easily possible to walk through a huge seismic data set and comprehend complex 3D features. The rendering of seismic volume data is the main computational burden. Figure 1 shows snapshots of a wave field propagating within the earth. The entire volume is lit by a light source and the rendering proceeds by tracing the light rays from the source to the observer taking into account the specular reflection of objects. Using this techniques we have visualized synthetically computed elastic wave fields. Figure 1 shows merely a 2D view of the wave field without any of the velocity model information. In the CUBE environment different data sets and volumes can be

[1] **email:** martin.karrenbach@physik.uni-karlsruhe.de

project at the same time. In our particular case, we overlaid isosurfaces of the velocity model with the displacement vector of the wave field. We could easily see how the wave field followed some of the large scale velocity features and which velocity variations were dominating.

We plan to use this facility more often in the future and hope to find a way to guide large-scale computations interactively from within the 3D immersive virtual reality environment.

This environment seems particularly useful for a combined interactive processing and interpretation scheme where, during the interpretation, processing of 3D seismic volumes could be initiated and where locally target oriented refined processing of 3D seismic volumes could take place. At the same time target oriented modeling of 3D seismic features could be carried out to validate the results or demonstrate feasibility.

CONCLUSION

The immersive 3D virtual reality facility is continuing to gather momentum in the petroleum industry. Some oil companies have opted to install such facilities in-house for 3D seismic interpretation and fluid flow modeling. The data can be visualized for a group of people immersed in the same environment leading to a group dynamic interaction between viewers, while observing the complex seismic objects naturally in 3D space.

ACKNOWLEDGMENTS

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REFERENCES

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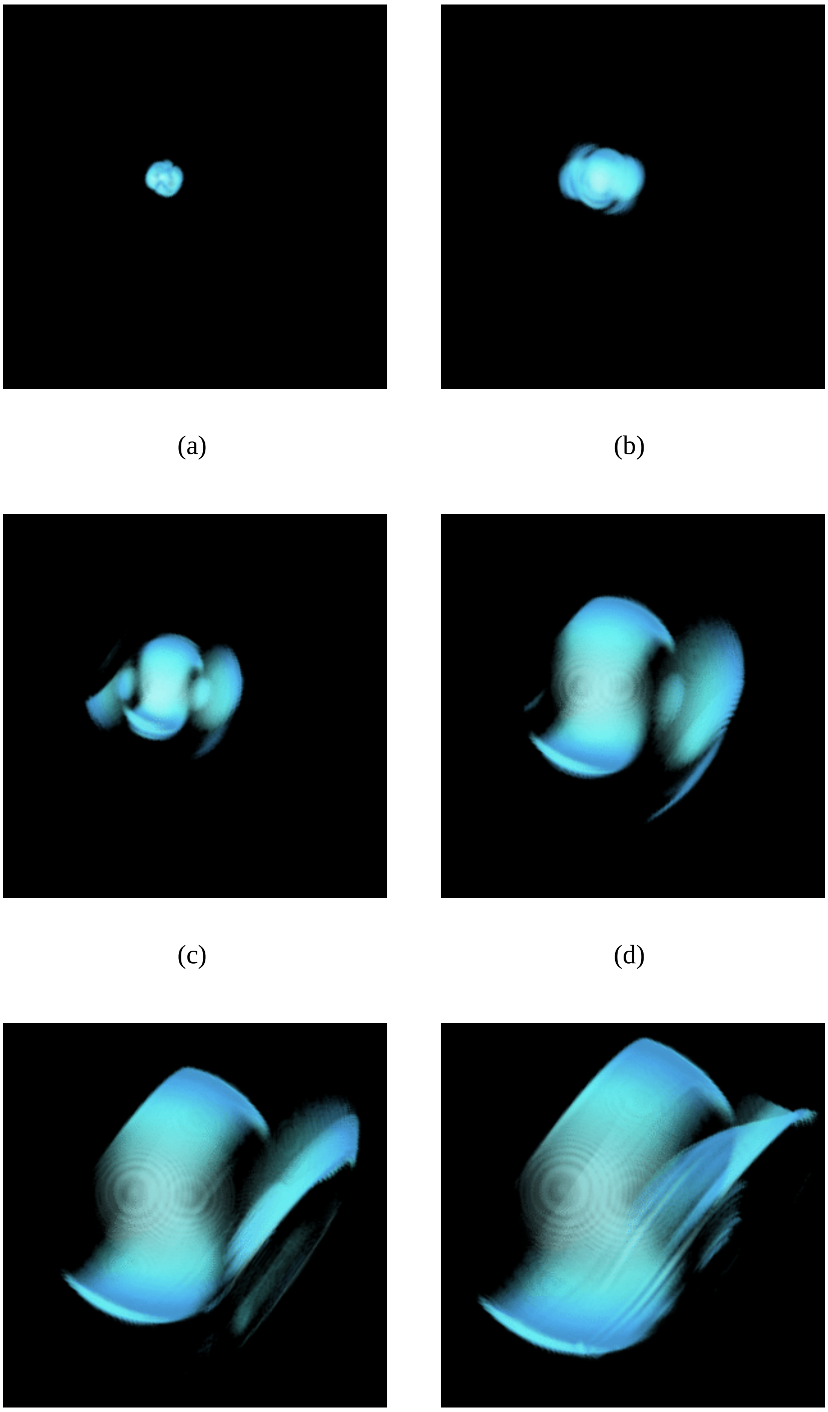

(a) (b) (c) (d) (e) (f)

Figure 1: A sequence of wave field snaphots generated during a seismic simulation, visualized using a volume rendering package and displayed using 3D stereo-graphic mode in the immersive CUBE environment.