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Immersive Visualization in π-CAVE

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SUMMARY

Visualization is a key step in the computer simulation study. It converts numerical data into mathematically defined abstract objects that are rendered into images by means of computer graphics technology. Researchers can "see" information hidden in the sea of numerical data. In accordance with the exponential growth of the simulation and computer hardware, complexity of the output data and, therefore, the difficulty of their visualizations are rocketing up these days. A new technology for visualization is strongly required and will be more in future. The modern virtual reality (VR) technology provides an answer to this challenge. Within various types of VR systems, a room-sized, projector-based, immersive-type virtual reality system, called CAVE, provides one of the best quality of VRs. Its user who stands in the CAVE room is surrounded by stereo images projected onto walls and the floor. A wireless motion capture technology with high speed graphics processors make it possible to render the visualized objects in virtual space in real time and in 3D from arbitrary view position and angle in the CAVE room. In Kobe University, one of the largest CAVE systems is installed in June, 2011. This system, π-CAVE, will be used not only for the data analysis, but also for the scientific communication, i.e., to convey the simulation results to non-specialists. In order to make the best use of CAVE's high quality VR, we are developing a new VR program "Multiverse". Multiverse is a kind of VR software framework, or an application launcher in VR. In the Multiverse environment, VR visualization applications are symbolized as virtual 3D "gates" that float in a VR space. Users standing in the π-CAVE's room can virtually "fly" to get closer to one of the gates and watch an expository movie that says what kind of visualization "Universe" is connected to the gate. When the user walks through the gate, a virtual "teleportation" brings him/her to the Universe. We are developing several visualization "Universes" and one of them, SeismicWave, will be shown in the talk. SeismicWave visualizes the wave propagation process of Tottori Seibu Earthquake (2000). The simulation was performed and the data was provided by Prof. Furumura, Tokyo University. A real time volume rendering is applied to the data to visualize the wave's energy density in π-CAVE. Details of the Multiverse's implementation and example movies of its Universes, especially SeismicWave, will be shown in the talk.