§1. Data Visualization by Virtual Reality System CompleXcope

Kageyama, A., Tamura, Y., Sato, T.

We installed a room-sized virtual reality (VR) system, named CompleXcope, in 1997 for the purpose of three-dimensional interactive data visualization of large-scale computer simulation[1]. CompleXcope is an immersive, projector based (or CAVE-type) VR system. Our CompleXcope has a cubic room (10' x 10' x 10') with 3 walls and a floor which are all screens. Numerical data, generally produced by our supercomputer NEC SX-4, is rendered by a high speed graphic workstation (SGI Onyx2, 4 x InfiniteReaity2), and stereo color images are projected onto the 4 screens (walls and floor). The images are smoothly and continuously connected at the screen boundaries. Viewers in the CompleXcope room, wearing stereo shutter glasses, are surrounded by stereo images of virtual objects. Its reality is very high.

In the "primitive age" (1997-1999) of our CompleXcope system, each simulation researcher who wanted to analyze his/her own data by CompleXcope had to code individual VR program, line by line[2]. Since the coding work requires some minimum knowledge about modern VR technology and computer graphics, it was not easy for them to learn proper coding style, and use CompleXcope perfectly. Since then, the most important issue for us, the CompleXcope development team, has been to improve the system's "usability" as a scientific research tool for all science researchers. We learned that it should be a "coding-less" system.

Fig.1 Menu system of VFIVE. The viewer shoots menu panels to choose visualization modules.

To realize such an automatic VR visualization system, we have developed a general purpose VR visualization program named VFIVE[3]). By using VFIVE, researchers can analyze their numerical data in the CompleXcope's virtual space without any coding work. VFIVE accepts general kind of three-dimensional data of scalar/vector fields in a specified format.

VFIVE has the following functions.

1. Interactive menu system (Fig. 1)
2. Various visualization modules for vector fields
3. Various visualization modules for scalar fields
4. 3D plot of prescribed curve
5. 3D plot of prescribed surface

Fig. 2 shows a typical snapshot of data analysis by VFIVE.

References

1) A. Kageyama, et al., *Data Visualization by a Virtual Reality System*, Proceedings of 16th International Conference on the Numerical Simulation of Plasmas, pp.138-142, Feb. 10-12, 1998, Santa Barbara, CA, USA.

2) A. Kageyama, Y. Tamura, and T. Sato, *Scientific Visualization in Physics Research by CompleXcope CAVE System*, Transactions of the Virtual Reality Society of Japan, Vol.4, pp.712-722, 1999

3) A. Kageyama, Y. Tamura, and T. Sato, *Visualization of Vector Field by Virtual Reality*, Progress of Theoretical Physics Supplement, No.138, pp.665-673, 2000

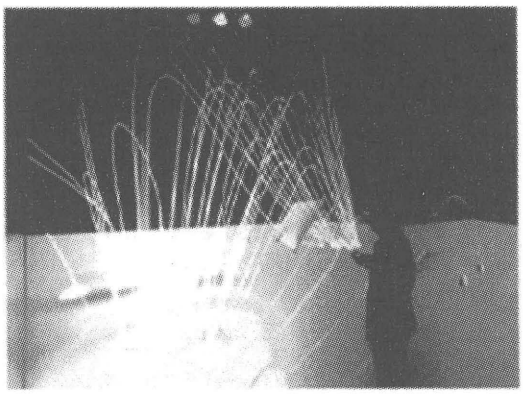

Fig.2 Snapshot of data analysis by VFIVE.