Parallel Depth-map Computer-generated Hologram Computation Algorithm with Area Segmentation

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Recently, public interest on the holographic three-dimensional (3D) displays increases with a strong need of new 3D mutimedia technology. The computer generated hologram (CGH) is hologram pattern displayed by the holographic display technology. The depth-map CGH is a method of computing the CGH by dividing 3D target model into multiple discrete layers according to the depth level of the 3D model [1]. Real-time computation of depth-map CGHs is important, however, the conventional depth-map CGH computation method has a problem that calculation time is considerably long for high resolution CGH. The parallel computation of depth-map CGH and the parallel computation of the depth-map CGH using several computers. The basic idea is the division of whole computation grid of CGH into several partial CGHs and the assignment of each partial CGH to a separate computer as illustrated in Fig. 1. In each sub-computer, FFT-based CGH calculation is performed for the partial CGH with lower resolution than the original hologram [2].





Fig. 1. Parallel Computation Method



In Fig. 2, we can see that the partial CGH computation time exponentially decreases as the segmentation number increases. The simulation was carried out using Matlab, and the calculation time with the number of parallelizations of 4000×4000 depth-map CGH is shown in Fig. 2. In the simulation, the computation time is reduced about 6.7 times compared to the single computation for the whole CGH. The composition algorithm of partial CGHs into a single CGH is researched. The final goal of this research is the development of accelerated parallel computation of high-resolution depth map CGH for high resolution 3D models without image quality degradation.

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