TTOM Awards

Holoxica
www.holoxica.com

Final Report Summary
Computer Generated Holography

Holoxica has developed a pioneering 3D holographic display system that suspends dynamic images {alphanumeric datafeeds, animations, advertisements and short 3D video sequences} in mid-air, creating a naturalistic 3D space in which a variety of content providers can present games, entertainment, advertisements and information. This technology eliminates the need for 3D glasses or other clumsy optical tricks. The company is focused on the research, design and development of a new generation of 3D holographic volumetric displays. A series of proof-of-concept screens have been fabricated using conventional methods with good results: wide viewing angle and high visibility under ambient lighting conditions.

The company has been working with traditional approaches to hologram implementation on silver-halide film and photopolymer. We want to investigate the feasibility of making our own holograms from scratch by computing the required interference pattern for eventual fabrication on advanced processes based on photolithography. This can lead to low-cost mass production via embossed manufacturing methods. This requires the development of custom tools based on computer-generated holography (CGH). The company lacks in-house knowledge on the use of CGH approaches to hologram design and implementation.

We started with the basic theory of CGH with point source propagation modelling and complex vector summation. This was taken forward into a mathematical algorithm, which quantizes the hologram plane and the object as point sources. We decided to go for Graphic Processing Units (GPUs) instead of supercomputers, which is a potentially low-cost solution. A one cubic cm surface area of space requires about 5 Terra FLOPs of calculations. The algorithm was implemented in a mathematical modelling language and ported to C and C-GPU. These were used to design near-field holograms that were verified experimentally using a Spatial Light Modulator.

The TTOM study fulfilled its aims as far as CGH theory, algorithms, coding, implementation and testing on a SLM. The objective of running the code on a supercomputer was not fully achieved because we switched to the GPU. The schedule was delayed due to learning curve and startup effects. We are confident that we will do this in the coming months with the right GPU accelerator hardware.