Stereoscopic Displays and Applications

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This special section was made possible by the enthusiasm of the research community in stereoscopic displays and applications, a level of interest that has now sustained the associated SPIE/IS&T Conference into its 25th year. This is a noteworthy achievement for such a young field in which there is now a depth and breadth of research that sustains a vibrant international group of researchers.

The fundamental challenges in the field include display design requiring the development of high quality optical elements that deliver controlled directional illumination in order to completely separate information intended for the left and right eyes. The article by Ishizuka et al. addresses this challenge, analyzing how dot matrix light sources can be collimated with convex lenses to generate a time-sequential backlight suitable for use with high-speed LCD image sources to create an autostereoscopic display system.

Recently computational methods have become central to many display designs, enabling a new range of optical configurations to become practical displays by utilizing advanced real-time image processing. The article by Jones et al. demonstrates this, combining eye-tracking and smooth real-time image interpolation to enable an array of pico-projectors to create an autostereoscopic display that supports multiple viewers. The resulting display system supports both horizontal and vertical parallax and can be constructed from off-the-shelf projectors, screen materials, and graphics hardware.

As displays increasingly gain higher quality, the challenge for content production is to respond with higher quality and more efficient methods for acquiring stereoscopic imagery. One important area of content production is omnidirectional stereoscopic imagery as analyzed by Gurrieri et al. This article proposes a mathematical framework to compare acquisition strategies to create stereoscopic panoramas using a small number of stereoscopic images, allowing an understanding and comparison of the trade-offs between different algorithms.

An underpinning theme across both displays and their applications is that of human factors since all of the components in the production and delivery chain must account for and work within the performance limits of the human visual system. The article by Lee et al. tackles the challenge of predicting when an observer will find a video to be uncomfortable. They investigate how stereoscopic disparity might combine with motion to form an overall prediction of visual discomfort. This takes a step toward establishing quality screening metrics for video content.

As researchers continue to address the fundamental challenges in stereoscopic displays and applications, we are moving closer to the possibility that stereoscopic information presentation will be an everyday experience on all display devices. Certainly over the 25 years of the SD&A conference, the displays, tools and standards have moved forward impressively and the potential impact of the field has been demonstrated in application areas as diverse as cinema, games, education, and health-care systems.

Thanks are due to the JEI editorial staff who patiently helped us bring this special section together while we were also working to deliver the 25th anniversary conference program. Thanks also to all of the reviewers who worked hard to ensure the submissions were of the highest quality and, of course, most importantly to the authors who submitted their work and who responded quickly to the reviewers' comments.