Evaluation of Dynamic Resolution in Simulators

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ABSTRACT

This paper recommends a new measurement procedure and test patterns to evaluate the dynamic resolution of simulation displays. The goal was to make measurements and validate results against visual observations. We also evaluate the effectiveness of various motion blur reduction (MBR) techniques.

As higher resolution projectors and displays become available it is important to understand the benefits and limitations they provide for simulation display systems. Not only is static resolution important, but dynamic resolution, a measure of the effective resolution observed in moving images, is extremely important to the users. Observable resolution degrades with motion and thus a specification and measurement method are needed to quantify the dynamic resolution. In projection display systems, various motion blur reduction (MBR) techniques are employed to minimize the loss of dynamic resolution in the scenes. One common motion blur reduction solution is to simply insert 50% dark time; however, that also reduces the brightness about 50%. Various techniques are employed which could be categorized by their active video write-time such as 16.7ms or 100% on, 12ms, or 8.3ms on-time, etc.

A common test method is to visually observe moving bar patterns and judge if they are discernable or not. In our testing, we used a synchronized pursuit camera to record the moving image as a relatively still image. The goal was to be able to measure what the eye sees with moving patterns and correlate the methods to each other. Once the video camera data is captured, it is analyzed with various mathematical algorithms.

Work has also been done to analyze the video content in typical simulation scenarios, and suggest practical test patterns based on the maximum video levels actually displayed. The investigations were done on both 60 Hz and 120 Hz refresh rates. Contrary to popular opinion, moving images refreshed at 120 Hz can also be improved with MBR techniques.

BIO

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Dave Eccles is the product manager for Rockwell Collins projectors used in flight simulators. He joined Rockwell in 2007 and has been a programs manager for head mounted displays then product manager for projectors. Highlights of his career include leading teams that developed the first HDTV in the USA, the world's first color liquid crystal light valve projector, and the first 2kx2k color monitor for air traffic control. He has been a display design engineer, project leader, program manager, manufacturing manager, VP of engineering for Sony TV design, consultant, expert witness for display patents, and product and programs manager. He is experienced leading the entire product life cycle process from business plan, product plan, budget, R&D, design, manufacturing, and service in commercial, industrial, and military markets. He has served as Americas VP for the Society for Information Display (SID), currently chairs the Display Systems technical paper committee for conferences, and has presented technical papers and display seminars throughout the world. He received his BSEE from the University of California at Irvine and attended graduate school at Purdue University.