A Strategy for Measurement and Incremental Maximization of Perceived Image Modulation

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ABSTRACT

How best to characterize image quality in a visual simulation system is still a subject of rigorous debate among academics; therefore it is wonder that how to best to leverage these metrics to optimize the realizable spatiotemporal luminance modulation with limited resources is still a largely unsolved problem within our industry. The entanglement between contributing performance parameters from the image generator and display system is a ubiquitous concern in the literature surrounding such image quality measurement strategies. The purpose of this paper is to elucidate an extensible procedure for collection and subsequent analysis of light field data that will yield not only a generalizable scalar metric for image quality but also the perceptually optimal path for differential performance improvements. The discussion begins with an experimental procedure for collection of light field data sufficient to construct the Modulation Transfer Function (MTF) of the display system as well as the extent to which it is utilized by the image generator. The aforementioned image quality metric, which operates on representative light field data and an appropriately formulated Contrast Sensitivity Function (CSF), is then derived and its utility to the problem of isolating independent image generator and display system performance parameters is established. Finally, using data collected from a modern high performance collimated display system and image generator under a variety of representative scenarios, the authors use this proposed analysis procedure to identify the performance bottlenecks in the combined visual simulation system.

BIO

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Caleb Klapp is an interdisciplinary software engineer who has been with FlightSafety International, Simulation - Visual Systems in St. Louis, MO since September 2010. He received a M.S. in Physics from Missouri University of Science & Technology in 2008, followed by an M.S. in Computer Science from University of Missouri-St. Louis in 2014. He is involved with most aspects of the visual simulation system with a particular focus on research and development in real-time rendering, color management, and image processing, as well as sensor and display sysem characterization.