

Pixelwise Inter/Intra Channel Color & Luminance Uniformity Corrections for Multi-Channel Projection Displays

Dr. Logan Williams
Dr. James Gaska, Mr. Charles Bullock

ABSTRACT

Inter- and intra-channel color and luminance are generally non-uniform in multi-channel projection display systems. Several methods have been proposed to correct for both inter- and intra-channel color and luminance variation in multi-channel systems in the past, with varying degrees of success. In this paper, a color and luminance correction method is proposed that alters the luminance and chromaticity of a projected image on an approximately pixel-wise basis by employing an imaging colorimeter. The final result is a pixel-wise gain mask, unique to each projector, which can be inserted into either the projection system or the image generator rendering pipeline to perform the required color calibration. This paper will describe the equipment, process, and algorithms required to perform such a correction using the Operational-Based Vision Assessment (OBVA) simulator as an example. Using this method, the 15-channel, 150-megapixel OBVA simulator display system is calibrated to uniform D65 and native white points, with uniform luminance, using luminance as the free parameter.

BIO

PRIMARY AUTHOR

Dr. Logan Williams is a senior research engineer at the U.S. Air Force School of Aerospace Medicine at Wright-Patterson AFB, Ohio, and currently leads technology development for the Operational Based Vision Assessment laboratory. Previously, he has led multiple lines of research in various fields such as human effectiveness, immersive environments, visual display system design, and distributed simulation for aircrew training. He has served as the lead systems engineer for F-16, A-10, and KC-135 aircrew training systems and has two decades of experience in analog and digital circuit design, networked control systems, optical & electro-optical system design, computer programming, and physics-based modeling and simulation. He has earned a PhD in Electro-Optics, ME and BS degrees in Electrical Engineering, as well as a BS in Physics.