High Dynamic Range Projectors:
a comparison of measured & modeled contrast

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ABSTRACT

Contrast in high dynamic range projection lenses is limited by stray light within the lens. This is caused by multiple reflections from lens element surfaces and scattered light from within the lens. This scattering can be due the lens internal mechanics, quality of lens polishing (surface roughness) and contamination on the surface of lens elements. In this paper we report on the contrast measurements and contrast simulations of a new Navitar zoom projection lens and we demonstrate likely maximum achievable limit with current manufacturing technologies.

BIO

PRIMARY AUTHOR

Russ Hudyma joined Navitar as Chief Technology Officer in February 2016 after the company acquired Hyperion Development, where he served as managing partner for over 15 years. Prior to that Russ was a Physicist at Lawrence Livermore National Laboratory and a Staff Scientist at the Santa Barbara Research Center in Coleta, CA. Russ has a bachelor's and master's degree in optics from the University of Rochester. He is an accomplished optical engineer, physicist and scientist, with experience in advanced design, analysis and modeling of lithographic optical systems. He has published more than 20 papers on microlithography and related topics, holds or has applied for more than 30 U.S. and foreign patents, and teaches a popular SPIE short course entitled, "Optical Design in the Ultraviolet." As managing partner of Hyperion Development, Russ spearheaded the creation of intellectual property resulting in 100+ patents either currently issued or pending. He developed and patented new catoptric design forms that will be the basis of future commercial extreme ultraviolet (EUV) lithographic printing tools in excess of 0.3 NA and commercial immersion lithographic printing tools in excess of 1.0 NA, developed new dioptric design forms for high-dry and immersion ArF lithography, designed novel compact extended range zooms for multispectral (VIS thru MWIR) and dual-band (MWIRLWIR) image acquisition and targeting, and developed SVD-based algorithms to align complex optical systems. He also developed and reduced to practice product families of 4K & 5K taking lenses for digital cinematography and a series of 2D/3D projection zoom lenses for DLP and SXRD digital cinema.