

O P T I C A L

R E S E A R C H

A S S O C I A T E S

Professional Experience

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| 2007-Present | Systems Engineer, Illumination Engineering Services, Optical Research Associates |
| 2006-2007 | Senior Engineer, Illumination Engineering Services, Optical Research Associates |
| 2003-2006 | Senior Optical Engineer, Hewlett-Packard Company |
| 2002-2003 | Optical Engineer, Tamarack Scientific Company |

Education

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| 2002 | Ph.D. in Optical Sciences, University of Arizona |
| 1999 | M.S. Optical Sciences, University of Arizona |
| 1997 | Five-year integrated graduate program in Physics, IIT Kanpur, India (special emphasis on Microelectronics and Fiber Optical Communication Systems) |

He joined ORA in 2007 bringing a broad experience in optical design, prototyping, and testing particularly of mid-resolution lithographic optics (projection and illumination) and also including,

- Digital projector optics (from source to screen)
- Backlights
- Lightpipes
- Luminaires
- Color technology
- Micro-optics
- Materials (optical)
- Thin films
- Sensors
- Light sources
- Stray light control

He employs a systems level approach towards problem solving and applies this to the design and analysis of primarily illumination systems in his role at ORA. He displays a keen interest in illumination optics and its application to such diverse areas as entertainment (toys, displays), biotechnology, solar technology, and novel applications. He is currently developing two book chapters on illumination design methods and is co-chairman of the prestigious 2010 International Optics Design Conference.

Patents

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| U.S. 7,312,928 | Projection system field lens |
| U.S. 7,310,186 | Uniform multiple light source etendue |
| U.S. 7,306,343 | Image rotator |
| U.S. 7,306,342 | Notch-filter reflector |
| U.S. 7,300,156 | Prism assembly for separating light |
| U.S. 7,295,293 | Apparatus and method for testing a reflector coating |
| U.S. 7,283,289 | Projection system modulator reducing distortion and field curvature effects of projection system lens |
| U.S. 7,281,804 | Prism assembly for separating light |
| U.S. 7,274,508 | Reflective projection screen with angled sidewalls |
| U.S. 7,249,855 | System and method of image enhancement through light intensity modulation in digital projectors |
| U.S. 7,246,922 | Lamp nose cone |
| U.S. 7,244,031 | Light source arrangement |

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| U.S. 7,204,599 | Offset Projection system |
| U.S. 7,198,834 | Imaging media including interference layer for generating human-readable marking on optical media |
| U.S. 7,188,962 | Light Modulator Device |
| U.S. 7,178,948 | Light Collection system |
| U.S. 7,167,316 | Projection Lens Assembly |
| U.S. 7,167,314 | Projector with total cross total internal reflection (TIR) prisms |
| U.S. 7,165,867 | Systems and methods for integrating light |
| U.S. 7,137,708 | Infra-red and ultraviolet filtration in projection systems |
| U.S. 7,136,209 | Light Modulators |
| U.S. 7,101,063 | Systems and methods for integrating light |
| U.S. 7,054,069 | Projection lens and image display system |
| U.S. 7,052,142 | Enhanced Resolution Projector |
| U.S. 7,046,419 | External aperture for digital micromirror device |
| U.S. 6,964,484 | Overfill reduction for an Optical modulator |

Publications

"Advanced Helmet Mounted Display," (with A. Sisodia, M. Bayer, P. Townley-Smith, B. Nash, J. Little, and W. Cassarly), Proc. SPIE 6557, (2007).

"Simplifying the lightpipe design process," (with R. J. Koschel), SPIE Newsroom, (2006).

"Characterization of lightpipes for efficient transfer of light," (with R. J. Koschel), Optics and Photonics meeting, SPIE 6557, (2005).

"A Wavefront Sensor for the human eye," Ph.D. dissertation, (2002).

"Spherical Aberrations in Human Eyes: Comparison of Normal, post-LASIK, and post-IOL eyes," (with J. Straub, J. Schwiegerling, J. M. Miller, and R. Anwaruddin), Poster Presentation at ARVO 2002, Ft. Lauderdale, FL, (May 2002).

"Lightpipe Design," (with J. Lee, and R. J. Koschel) Optics and Photonics News, 53, (December 2001).

"Design of efficient lightpipes for illumination by an analytical approach," (with J. Lee, and R. J. Koschel) Applied Optics 40, 22, 3640-3648, (August 2001).

"Hidden Devices that light our world Lightpipes," (with B. Cassarly, D. Jenkins, and R. J. Koschel), Optics and Photonics News, 34-39, (August 2001).

"Design and use of an infrared Pupilometer for real-time pupil mapping in response to incremental illumination levels," (with J. Schwiegerling, and J. Straub), OSA, Monterey, CA, (February 9-12, 2001).

"Design of compact Shack-Hartmann aberrometer for real-time measurement of aberration in human eyes", (with J. Straub, J. Schwiegerling), OSA, Monterey, CA, (February 9-12, 2001).

"The use of implicitly defined aspheric null correctors for the testing of conformal optical elements", with S. Lerner, J. Sasian, J. Grievenkamp), OSA, Quebec, Canada, (June 18-22, 2000).

"Transmitted Wavefront Testing of Conformal Windows", (with J. Greivenkamp, D. Smith, R. Gappinger, G. Williby, P. Marushin, S. Clark, J. Lee and J. Sasian), OSA, Quebec, Canada, (June 18-22, 2000).

“Dark states of dressed Bose-Einstein condensates”, (with E. Lee, C. Geckler, J. Heurich, K. Cheong, S. Secrest, and P. Meystre), *Physical Review A* 60, 4006 (1999).

“Static tester for characterization of phase-change, dye polymer, and magneto-optical media for optical data storage,” (with M. Mansuripur, J. Erwin, W. Bletscher, P. Khulbe, K. Sadeghi, X. Xun, and S. Mendes), *Applied Optics* 38, 7095 (1999).

Professional Societies

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| 2010 | Cochairman, 2010 International Optics Design Conference |
| 2006-2008 | Chairman, Optical design technical group |
| 2006-2008 | Chairman, FIO |
| 2006-2008 | Chairman, Optical Society of America |
| 2008 | Chairman, Illumination Topical Meeting, OSA |
| Reviewer, SPIE | The American Society of Precision Engineering |
| Review, OSA | Optical Society of America |
| Member, OSA | Optical Society of America |
| Member, SPIE | The International Society for Optical Engineering |
| Member, IESNA | Illuminating Engineering Society of North America |