

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

2007-present	Director of Optical Engineering Services, Optical Research Associates
2007-2007	Acting Director of Illumination Optics, Optical Research Associates
2003-2007	Senior Scientist, Optical Research Associates
2000-2003	Principal Engineer/Photonic Product Development, Optical Research Associates
1999-2000	Senior Systems Engineer/Optical Design, Optical Research Associates
1996-1999	Systems Engineer/Optical Design, Optical Research Associates
1990-1996	Member of Technical Staff, Jet Propulsion Laboratory
1986-1990	Graduate Research Assistant, University of Alabama in Huntsville, Physics Department
1984-1986	Laboratory Assistant, University of Alabama in Huntsville

Education

1990	Ph.D. in Physics, University of Alabama in Huntsville
1988	M.S. in Physics, University of Alabama in Huntsville
1986	B.S. in Physics, University of Alabama in Huntsville
2006	Caltech Certificate for Technology Management

He has been Director of Optical Engineering services at of Optical Research Associates (ORA[®]) since 2007 and has been leading a team of optical designers in both imaging and illumination optics providing state-of-the-art optical system development services throughout the world.

His prior technical experience has concentrated in the invention and development of new optical systems for displays, microlithography, fiber optics, and remote sensing optics with 27 patents, 32 pending published patent applications, and 21 papers. He has led development of new optical systems from concept and specification through design, integration, and test. His roles have included: system engineering (i.e. translating customer needs into detailed optical specifications), conceptual and detailed design, detailed analysis of system performance (often including custom macro, Mathematica, C, and Fortran code), error budgets, sensitivity analysis and piece part tolerance assignment, vendor selection, and development/implementation of alignment and test procedures. His specialties include display, telecommunications, polarization, and lithography.

He has pioneered the application of computer optimization to lithographic illuminators including the development of fast merit functions and novel optical surface descriptions. He has also developed efficient tolerance methods for condensers and has designed projection optics for lithography.

He designed the following systems that have been built: head mounted displays, an EUV condenser for microlithography, machine vision lenses, long-wave IR channel for an airborne tracker, a micro-projection lens, laser illuminator for a micro-projector, and high precision null lenses.

He joined the technical staff of the Jet Propulsion laboratory in 1990, where he was the principal optics engineer on many hardware projects. He was responsible for the error budgets, tolerances, alignment and test (both on the ground and in orbit) of the optics for the Wide-Field/Planetary Camera-II (WF/PC-II), which corrected for the Hubble Space Telescope (HST) spherical aberration. He designed, assembled, and tested an off-axis F/3 solar UV telescope and tracker for Table Mountain Observatory. He designed a polarization corrector and a depolarizer for Multi-angle Imaging Spectroradiometer (MISR), which is successfully operating in orbit. He conceived the original system design for the Fizeau Astrometric

Mapping Experiment (FAME), original system architecture for the Separated Spacecraft Interferometer (SSI), and performed optical analysis of the Space Interferometer Mission (SIM).

He obtained his Ph.D., with a dissertation focused on polarization aberrations in optical systems. He extended polarization theory of rotationally symmetric systems to fourth order and to tilted and decentered systems; formulated Fourier optics for systems with polarization aberrations; and analyzed the effect of polarization aberrations on optical transfer functions (OTF).

As an undergraduate laboratory assistant he designed and supervised the implementation of procedures to qualify and calibrate photomultiplier tubes and NaI (TI) crystals for flight on Burst and Transient Source Experiment (BATSE) on the Gamma Ray Observatory Satellite.

Awards/Honors

- 1994 NASA Exceptional Achievement Medal, "Wide Field/Planetary Camera-II"
- 1994 Six NASA Group Achievement Awards
- 1994 NASA Manned Flight Awareness Honoree Award
- 1984 National Merit Scholar

Patents

- U.S. 7,330,615 Wavelength selective optical switch
- U.S. 7,206,133 Light distribution apparatus and methods for illuminating optical systems
- U.S. 7,203,421 Littrow grating based OADM
- U.S. 7,196,849 Apparatus and methods for illuminating optical systems
- U.S. 7,177,493 Programmable optical add/drop multiplexer
- U.S. 7,075,720 Structures and methods for reducing polarization aberration in optical systems
- U.S. 7,075,696 Correction of birefringence in cubic crystalline optical systems
- U.S. 7,072,102 Methods for reducing polarization aberration in optical systems
- U.S. 7,058,251 Wavelength selective optical switch
- U.S. 7,046,338 EUV condenser with non-imaging optics
- U.S. 7,009,769 Correction of birefringence in cubic crystalline optical systems
- U.S. 6,995,908 Methods for reducing aberration in optical systems
- U.S. 6,970,232 Structures and methods for reducing aberration in integrated circuit fabrication systems
- U.S. 6,958,864 Structures and methods for reducing polarization aberration in integrated circuit fabrication systems
- U.S. 6,947,192 Correction of birefringence in cubic crystalline optical systems
- U.S. 6,941,073 East-west separable ROADM
- U.S. 6,917,458 Correction of birefringence in cubic crystalline optical systems
- U.S. 6,885,488 Semiconductor device and method for forming the same using cubic crystalline optical system with reduced birefringence
- U.S. 6,844,972 Reducing aberration in optical systems comprising cubic crystalline optical elements
- U.S. 6,760,095 EUV condenser with non-imaging optics
- U.S. 6,683,710 Correction of birefringence in cubic crystalline optical systems
- U.S. 6,636,654 Programmable optical switching add/drop multiplexer
- U.S. 6,573,978 EUV condenser with non-imaging optics
- U.S. 6,210,865 Extreme-UV lithography condenser
- U.S. 6,195,201 Reflective fly's eye condenser for EUV lithography
- U.S. 6,144,495 Projection light source
- U.S. 6,122,107 Angular integrator

Patents Pending

U.S. 20070252954	Beamsplitting Structures and Methods in Optical Systems
U.S. 0070177275	Personal Display Using an Off-Axis Illuminator
U.S. 20070104418	Wavelength selective optical switch
U.S. 20070024971	Rippled mixers for uniformity and color mixing
U.S. 20070019408	Phosphor wheel illuminator
U.S. 20060250696	Head mounted display devices
U.S. 20060187549	Methods for reducing polarization aberration in optical systems
U.S. 20060182387	Wavelength selective optical switch
U.S. 20060119951	Compact head mounted display devices with tilted/decentered lens element
U.S. 20060050400	Correction of birefringence in cubic crystalline optical systems
U.S. 20050195506	Grazing incidence relays
U.S. 20050036201	Correction of birefringence in cubic crystalline optical systems
U.S. 20050018309	Apparatus and methods for illuminating optical systems
U.S. 20050018308	Light distribution apparatus and methods for illuminating optical systems
U.S. 20050008870	EUV condenser with non-imaging optics
U.S. 20040145806	Correction of birefringence in cubic crystalline optical systems
U.S. 20040136718	East-West separable ROADM
U.S. 20040036985	Structures and methods for reducing polarization aberration in integrated circuit fabrication systems
U.S. 20040036971	Methods for reducing polarization aberration in optical systems
U.S. 20040036961	Structures and methods for reducing polarization aberration in optical systems U.S.
U.S. 20040033010	Wavelength selective optical switch
U.S. 20040001244	Semiconductor device and method for forming the same using cubic crystalline optical system with reduced birefringence
U.S. 20030234981	Correction of birefringence in cubic crystalline optical systems
U.S. 20030215179	Programmable optical add/drop multiplexer
U.S. 20030142283	EUV condenser with non-imaging optics
U.S. 20030099047	Correction of birefringence in cubic crystalline optical systems
U.S. 20030090762	Littrow grating based oadm
U.S. 20030086171	Methods for reducing aberration in optical systems
U.S. 20030086157	Reducing aberration in optical systems comprising cubic crystalline optical elements
U.S. 20030086156	Structures and methods for reducing aberration in optical systems
U.S. 20030086071	Structures and methods for reducing aberration in integrated circuit fabrication systems
U.S. 20020196494	Programmable optical add/drop multiplexer

Publications

“Design of a Mid-IR Polarimeter for SOFIA,” Proc. SPIE 1, (2008).

“The role of Jones matrices in Critical Dimension computation for immersion lithography,” Invited talk, (with R.L. Gordon and M.P. Rimmer), OSA Ann. Mtg., (2006).

“Designing easily manufactured lenses using a global method,” Proc. IODC, TuA6 (2006).

“Advanced Helmet Mounted Display (AHMD) for simulator applications,” (with A. Sisodia, A. Riser, and M. Bayer), Proc. SPIE 6224, 23 (2006).

“A fly's eye condenser system for uniform illumination,” (with B. Crowther, D. Koch, J. Kunick, R. Harned, and R. Gontin), Proc. SPIE 4832, (2002).

“Design and Birefringence Modeling for 157 nm Lithography,” (with J. Hoffman and K. Doyle), Presented at International SEMATECH, 7 May 2002.

"A High Resolution Fourier-Transform UV-Visible Spectrometer for the Measurement of Atmospheric Trace Species: Application to OH," (with R. Cageao, J. Blavier, Y. Jiang, V. Nemtchinov, F. Mills, and S. Sander), Applied Optics 40, 12, 2024 (2001).

"The Preliminary Optical Design of AIRES: An Airborne Infra-Red Echelle Spectrometer for SOFIA," (with M. Haas, E. Erickson, J. Baltz, S. Colgan, D. Lync, R. Pina, T. Roellig, J. Simpson, C. Telesco, J. Wolf, and E. Young), Proc. SPIE 3354, 940 (1998).

“Polarization Aberrations I: Rotationally Symmetric Optical Systems,” (with R. Chipman), Applied Optics 33, 22, 5080 (1994).

“Polarization Aberrations II: Tilted and Decentered Optical Systems,” (with R. Chipman), Applied Optics, 33, 22, 5101 (1994).

“Optical Alignment and Ambient Test of Wide-Field/Planetary Camera-II,” (with R. Korechoff), Proc. SPIE, 1996 (1993).

“Tolerancing of the Wide-Field/Planetary Camera-II,” (with R. Korechoff), Proc. SPIE 1993, (1993).

“Alignment of the second generation Wide-Field/Planetary Camera: Metrology of a highly aberrated system,” (with R. Korechoff, S. Macenka, and J. Oseas), OSA. Tech. Digest 24 (1992).

“Linear diattenuation of a front-side illuminated CCD,” (with A. Deslis and S. Smith), Proc. SPIE 1746, (1992).

“Design of Wide-Field/Planetary Camera 2 for the Hubble Space Telescope,” (with N. Page), OSA Tech. Digest 19, (1991).

“Diffraction image formation in optical systems with polarization aberrations II: Amplitude response matrices for rotationally symmetric systems,” (with R. Chipman), JOSA 8, 6, 833- (1991).

“Diffraction image formation in optical systems with polarization aberrations I: Formulation and example,” (with R. A. Chipman), JOSA 7, 9, 1614- (1990).

“Analysis of spatial pseudodepolarizers in imaging systems,” (with R. Chipman), Opt. Eng. 29, 1478 (1990).

“Polarization aberrations in the Solar Activity Measurements Experiments (SAMEX) vector magnetograph,” (with R. Chipman), Opt. Eng. 28(2), 141 (1989).

“Polarization bibliography,” (with R. Chipman and R. Fuller), Proc. SPIE 1166, 420 (1989).

“Polarization accuracy of LEST,” (with R. Chipman), LEST Technical Report Series, Rept. 35, University of Oslo, (1988).

“Polarization Aberrations in Optical Systems,” (with R. Chipman), Proc. SPIE 818, 240 (1987).

Professional Societies

Member, IEEE Institute of Electrical and Electronics Engineers
Member, OSA Optical Society of America
Member, SID Society for Information Display
Member, SPIE International Society for Optical Engineering