

Resume: William H. Southwell

Education:

B. S. Physics	Brigham Young University
Ph. D. Physics	Brigham Young University

Employment History:

Professor of Physics	4 years	South Dakota School of Mines and Technology
Optical Physicist	3 years	Owens Illinois
Member Technical Staff and		
Staff Scientist	24 years	Rockwell International
Consultant	6 years	Table Mountain Optics

Dr. Southwell is a theorist with emphasis on numerical analysis and modeling of optical systems and light propagation. He has contributed creatively in a wide range of subjects, including least squares variance analysis and optimization techniques, phase retrieval, optical waveguide propagation, Luneburg lenses, gradient-index lenses, unstable resonator modes, telescope design, irradiance redistribution, optical interference filters, and diffractive binary optics. He is the author of the virtual source theory of unstable resonator lasers, the thin film 90° phase shift coating, a ray-tracing code to trace kinoform lenses, the quintic semi-infinite band antireflection coating, coupled wave theory for rugate filters, the digital thin-film equivalence principle and flip-flop thin-film design method (featured on the cover of Applied Optics). His work is published mostly in the Optical Society journals, where he has also served in various editorial positions.

Some of his accomplishments in rugate technology include: Rugate coupled-wave theory, software for fast single line rugate spectral evaluation, digital flip-flop thin film design, quintic antireflection design, analog rugate fabrication with rate control, broadband spectral monitor for rugate deposition, software for multi-line rugate filter design, eye-centered design, apodization to suppress sidebands, modified exponential sine waves to suppress all harmonics, error compensation monitoring for rugate deposition, wavelet theory for rugate filter design, enhanced thin film (ETF) design methods.

He has authored hundreds of technical reports and has published over 60 papers in national journals. He holds 23 patents, most of which deal with optical thin films. Dr. Southwell was elected a Fellow of the Optical Society of America for “contributions to gradient-index coatings and other analytical and computational aspects of physical optics and thin films.”

Dr. Southwell is noted for his ability to design optical coatings with difficult spectral requirements. He was the first place winner in world coating design contest (Berlin SPIE, 1992). He was a category winner in the OIC design contest (1995).

Currently, he is the owner of Table Mountain Optics, where he performs optical modeling, design, and analysis. He has written several optical software modeling and design tools.

Publications of William H. Southwell

1. William H. Southwell and J.D. Patterson, "Green's Function Decoupling Methods," Bull. Amer. Phys. Soc. **12**, 903 (1967).
2. William H. Southwell, "Using Pendulums to Measure the Universal Gravitational Constant," Amer. J. Physics **35**, 1160-1161 (1967).
3. J. D. Patterson and William H. Southwell, "Green's Function Theory of Ferromagnetism," Amer. J. Physics **36**, 343-350 (1968).
4. W. H. Southwell, D. L. Decker, and H. B. Van fleet, "Mossbauer Effect Measurements in Iron at High Pressures," Phys. Rev. **171**, 354-360 (1968).
5. W.H. Southwell, "Fitting Experimental Data," J. Computational Physics **4**, 465-474 (1969).
6. W.H. Southwell, "Sine-Wave Optical Paths in Gradient-Index Media," J. Optical Soc. Amer. **61**, 1715 (1971).
7. W. H. Southwell, "Coherent Interference Pattern from a Cylindrical Glass Tube," Amer. J. Physics **41**, 284-286 (1973).
8. W. H. Southwell, "Fitting data to nonlinear functions with uncertainties in all measurement variables," Computer J. **19**, 69-73 (1976).
9. W. H. Southwell, "Wave-front analyzer using a maximum likelihood algorithm," J. Optical Soc. Amer. **67**, 396-399 (1977).
10. W. H. Southwell, "Inhomogeneous optical waveguide lens analysis," J. Optical Soc. Amer. **67**, 1004-1009 (1977).
11. W. H. Southwell, "Index profiles for generalized Luneburg lenses and their use in planar optical waveguides," J. Optical Soc. Amer. **67**, 1010-1014 (1977).
12. W. H. Southwell, "Geodesic optical waveguide lens analysis," J. Optical Soc. Amer. **67**, 1293-1299 (1977).
13. W. H. Southwell, "Asymptotic solution of the Huygens-Fresnel integral in circular coordinates," Optics Lett. **3**, 100-102 (1978).

14. W. H. Southwell, "Beam expander telescope design utilizing fast spherical primaries," *Applied Optics* **18**, 1240-1243 (1979).
15. W. H. Southwell, "Geodesic profiles for equivalent Luneburg lenses," *J. Optical Soc. Amer.* **69**, 792-793 (1979).
16. W. H. Southwell, "Mode discrimination of unstable resonators with spatial filters and by phase modification," *Optics Lett.* **4**, 193-195 (1979).
17. W. H. Southwell, "Multilayer high reflective coating designs achieving broadband 90° phase change," *SPIE* **190**, LASL Optics Conf. 81-88 (1979).
18. W. H. Southwell, "Multilayer coatings producing 90° phase change," *Applied Optics (Rapid Communications)* **18**, 1875 (1979).
19. G. A. Tyler and W. H. Southwell, "Synthesis of the vector resonator modes from scalar results," *Optics Lett.* **5**, 42-44 (1980).
20. J. K. Guha, Paul W. Scott, and W. H. Southwell, "Effect of infrared coating nonuniformity on optical systems," *Applied Optics* **19**, 1320-1322 (1980).
21. W.H. Southwell "Wave-front estimation from wave-front slope measurements," *J. Optical Soc. Amer.* **70**, 998-1006 (1980).
22. W. H. Southwell, "Multilayer coating design achieving a broadband 90° phase shift," *Applied Optics* **19**, 2688-2692 (1980).
23. W. H. Southwell, "Validity of the Fresnel approximation in the near field," *J. Optical Soc. Amer.* **71**, 7-14 (1981).
24. W. H. Southwell, "Azimuthally polarized lasers and phase shift coatings," *Proc. Int. Conf. on Lasers '80*, C. B. Collins, Editor, 602-609 (1980).
25. Paul W. Scott and W. H. Southwell, "Reflective optics for irradiance redistribution of laser beams: design," *Applied Optics* **20**, 1606-609 (1981).
26. W. H. Southwell, "Thin Film Transmissive Phase Retarders," *Proc. Int. Conf. on Lasers '81*, C. B. Collin, Editor, 578-585 (1981).
27. W. H. Southwell, "Virtual-source theory of unstable resonator modes," *Optics Letters* **6**, 487-489 (1981).
28. W. H. Southwell, "Planar optical waveguide lens design," *Applied Optics* **21**, 1985-1988 (1982).

29. W. H. Southwell, "Ray tracing in gradient-index media," *J. Optical Soc. Amer.* **72**, 908-911 (1982).
30. W. H. Southwell, "What's wrong with cross coupling in modal wave-front estimation?," *Proc. SPIE*, V. **365**, r. J. Becherer and B. A. Horwitz Editors, p. 97-104 (1982).
31. Van E. Wood, James R. Busch, Duncan T. Moore, C. Benjamin Woolely and W. H. Southwell, "Rectangular Luneburg-type lenses for integrated optics," *Optics Letters* **8**, 226-228 (1983).
32. W. H. Southwell, "Gradient-index antireflection coatings," *Optics Letters* **8**, 584-586 (1983).
33. W. H. Southwell, "Use of gradient-index for spectral filter," *Proc. SPIE* **464**, 110-114 (1984).
34. Haluk Sankur and W. H. Southwell, "Broadband gradient-index antireflection coating for ZnSe," *Applied Optics* **23**, 2770-2773 (1984).
35. D. A. Nahrstedt and W. H. Southwell, "Maximum likelihood phase retrieval algorithm: applications," *Applied Optics* **23**, 4328-4331 (1984).
36. W. H. Southwell "Design of High Power Laser Coatings for Grazing Incidence Mirrors," *Laser Induced Damage in Optical Materials: 1984*, NBS Special Publication **727**, 322-329 (1986).
37. W. H. Southwell, "Coating design using very thin high and low-index layers," *Applied Optics* **24**, 457-460 (1985).
38. W.H. Southwell, "Coherence loss due to thin film interface roughness," *Proc. Of SPIE* **652**, 300-306 (1986).
39. W. H. Southwell, "Unstable-resonator-mode derivation using virtual source theory," *J. Optical Soc. Amer.* **A 3**, 1885-1891 (1986).
40. W. H. Southwell, W. J. Gunning, and R. L. Hall, "Narrow-bandpass filter using partitioned cavities," *Proc. SPIE* **678**, 177-184 (1986).
41. R. L. Hall, W. H. Southwell and W. J. Gunning, "Ellipsometry as a real-time deposition monitor," *Proc. SPIE* **818** (1987).
42. J. K. Moyle, W. J. Gunning III, and W. H. Southwell, "Microstructure modeling: scattering and form birefringence in dielectric thin films," *Proc SPIE* **821**, 157-166 (1987).

43. W. H. Southwell, "Rugate index profile; which suppresses all harmonic stopbands," *Optical Interference Coatings*, 1988 Technical Digest Series **6**, 142-145, (1988).
44. R. L. Hall, W. H. Southwell, and W. J. Gunning, "The Fabrication of Rugate Filters Using the Digital Technique," *Optical Interference Coatings*, 1988 Technical Digest Series **6**, 154-157. (1988).
45. W. H. Southwell, "Spectral response calculations of rugate filters using coupled-wave theory," *J. Optical Soc. Amer.* **A 5**, 1558-1564 (1988).
46. W. H. Southwell and W. J. Gunning, "High-speed ellipsometer for thin-film deposition monitoring," *SPIE* **1019**, 84-89 (1988).
47. William J. Gunning, Randolph L. Hall, Frank J. Woodberry, W. H. Southwell, and Natalie S. Gluck, "Codeposition of continuous composition rugate filters," *Applied Optics* **28**, 2945-2948 (1989).
48. W. H. Southwell and Randolph L. Hall, "Rugate filter sidelobe suppression using quintic and rugated quintic matching layers," *Applied Optics* **28**, 2949-2951 (1989).
49. William H. Southwell, "Using apodizations functions to reduce sidelobes in rugate filters," *Applied Optics* **28**, 5091-5094 (1989).
50. William H. Southwell, "Pyramid-array surface-relief structures producing antireflection index matching on optical surfaces," *J. Optical Soc. Amer.* **A 8**, 549-553 (1991).
51. M. E. Motamedi, W. H. Southwell, R. J. Anderson, L. G. Hale, W. J. Gunning, and M. Holz, "High speed binary optic microlens array in GaAs," *SPIE* **1544**, 33-44 (1991).
52. H. Sankur, W. H. Southwell, and R. Hall, "In-Situ Optical Monitoring of OMVPE Deposition of AlGaAs by Laser Reflectance," *J. Electronic Materials* **20**, 1099-1104 (1991).
53. William H. Southwell, "Diffraction efficiency of multi-level binary optics lenses," in *Diffraction Optics: Design, Fabrication, and Applications Technical Digest*, 1992 (Optical Society of America, Washington, D.C., 1992), Vol. **9**, pp. 157-159.
54. William H. Southwell, "Ray tracing kinoform lens surfaces," *Applied Optics* **31**, 2244-2247 (1992).
55. M. E. Motamedi, W. H. Southwell, and W. J. Gunning, "Antireflection surfaces in silicon using binary optics technology," *Applied Optics* **31**, 4371-4376 (1992).

56. William H. Southwell, "Focal-plane pixel-energy redistribution and concentration by use of microlens arrays," *Applied Optics*, **33**, 3460-3464 (1994).
57. William H. Southwell, "Extended-bandwidth reflector designs by using wavelets," *Applied Optics* **36**, 314-318 (1997).
58. William H. Southwell, "Sealing rules for quintic refractive index matching semi-infinite band antireflection coatings," *Proc. SPIE* **3133**, 65-70 (1997).
59. William H. Southwell, "Omnidirectional mirror design with quarter-wave dielectrics stacks," *Applied Optics* **38**, 5464-5467 (1999).
60. W. H. Southwell, "Principle for the rugate polarizer," *Proc. OIC Meeting, Banff, Canada* (2001).
61. W. H. Southwell, "Comparison of needle-function predictions to exact calculations," *Proc. OIC Meeting, Banff, Canada* (2001).
62. W. H. Southwell, "Three layer equivalent theory for a layer having n and k ," *Proc. OIC Meeting, Tucson* (2004).
63. W. H. Southwell, "Computer-assisted manual coating design approach," *SPIE* **5527** (2004).

Patents of William H. Southwell

1. U. S. Patent No. 3,784,308. Method and apparatus for measuring index of refraction of glass disks.
2. U.S. Patent No. 3,873,208. Refractometer for measuring the refractive index of solid, liquid, or gaseous materials in cylindrical shapes or containers.
3. U.S. Patent No. 3,994,599. Method and apparatus for measuring wall thickness and concentricity of tubular glass articles.
4. U. S. Patent No. 4,312,570. High reflectivity coated mirror producing 90° phase shift.
5. U. S. Patent No. 4,536,063. Thin film transmissive phase retarder.
6. U. S. Patent No. 4,583,822. Quintic refractive index profile antireflection coatings.

7. U. S. Patent No. 4,666,250. Optical coating design using flip-flop optimization.
8. U. S. Patent No. 4,707,611. Incremental monitoring of thin films.
9. U. S. Patent No.4,756,602. Narrowband optical filter with partitioned cavity.
10. U. S. Patent No. 4,778,251. Thickness error compensation for digital gradient-index optical coatings.
11. U. S. Patent No. 4,826,267. Spectral filter with integral antireflection coating.
12. U. S. Patent No. 4,934,788. Deposition of gradient index coatings using coevaporation with rate control.
13. U. S. Patent No. 5,000,575. Method of fabricating gradient index optical films.
14. U. S. Patent No.5,100,233. Refractive index monitor for deposition of gradient-index films.
15. U. S. Patent No. 5,144,484. Binary optic lens design using flip-flop optimization.
16. U. S. Patent No. 5,181,143. Multiple line rugate filter with index clipping.
17. U. S. Patent No.5,410,431. Multi-line narrowband-pass filters.
18. U. S. Patent No. 5,425,964. Deposition of multiple layer thin films using a broadband spectral monitor.
19. U. S. Patent No. 5,559,640. Automotive rear view mirror system.
20. U. S. Patent No. 5,828,489. Narrow wavelength polarizing beamsplitter.
21. U. S. Patent No. 6,392,801. Wide-angle rugate polarizing beamsplitter.
22. U. S. Patent No. 6,400,513. Optical beam coupling of multiple wavelengths into an output channel using spatial wavefront segmentation.
23. U. S. Patent No. 6,885,504. Method for the design and fabrication of complementary optical comb filter pairs.