

STEPHEN SCHULTZ

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EDUCATION

1999 Georgia Institute of Technology Atlanta, GA

Ph.D. Electrical Engineering

- Dissertation Title: High Efficiency Volume Grating Coupler

1994 Brigham Young University Provo, UT

M.S. Electrical Engineering

- Thesis title: Resonant Tunneling Analysis of Slab Waveguides

1992 Brigham Young University Provo, UT

B.S. in Electrical Engineering

COURSE TAUGHT

New Student Seminar (ECEn191)

Circuits (ECEn212)

Electronic Circuit Design 1 (ECEn313)

Fields and Waves (ECEn360)

Transmission Lines for High-Speed Digital Systems (ECEn 362)

Electromagnetic Radiation and Propagation (ECEn 462)

Introduction to Optical Engineering (ECEn 466)

Free Space Optical Communications (ECEn490)

Optical Communication Components and Systems (ECEn 562)

Advanced Optical Engineering (ECEn 661)

PROFESSIONAL EXPERIENCE

Associate Professor (2008-Present)

Department of Electrical Engineering, Brigham Young University, Provo, UT

- Supervise and guide undergraduate and graduate research projects
- Manage optical fiber research program

Assistant Professor (2002-2008)

Department of Electrical Engineering, Brigham Young University, Provo, UT

- Teach undergraduate and graduate students
- Supervise and guide master's and doctorate students' thesis work
- Supervise and guide undergraduate research and senior level projects
- Establish and direct Optical Fiber Device research program

Consultant (2003-2004)

L-3 Communications, Communications Systems West, Salt Lake City, UT

- Analyzed the advantages and disadvantages of free space laser communications for air-to-air, air-to-satellite, and air-to-ground.
- Analyzed atmospheric propagation of lasers.

Senior Staff Engineer (1999-2002)

Raytheon Missile Systems, Tucson, AZ

- Performed optical design and stray light analysis on various passive infrared imaging missile seekers and active laser radar systems.
- Supplied support for the testing of the optical performance of existing missile seekers
- Contributed to various internal research and development programs including: hyper-spectral imaging, photonic bandgap structures applied to radar missiles, and other classified work.

Graduate Research Assistant (1994-1999)

Department of Electrical Engineering, Georgia Institute of Technology, Atlanta, GA

- Developed computer simulation code for analysis of gratings
- Built and tested sub-micron period surface-relief and volume gratings.
- Designed, built, and tested a guided wave optical interconnect

Graduate Internship (Apr. 1997-June 1997)

Motorola's Phoenix Applied Research Center, Tempe, AZ

- Investigated the application of diffractive optics onto vertical cavity surface emitting lasers for use in the commercial parallel optical interconnect system OPTOBUS™.

PUBLICATIONS AND PATENTS

Archival Journal Publications

1. B. Todd, M. Phillips, S. Schultz, A. Hawkins, and B. Jensen, "Low cost RFID shock sensors," *IEEE Sensors Journal*, vol. 9, No. 4, p. 464-469, Apr. 2009.
2. R. Gibson, R. Selfridge, and S. Schultz, "Electric field sensor array from cavity resonance between optical D-fiber and multiple slab waveguides," *Appl. Opt.*, vol. 48, no. 19, p. 3695-3701, Jul. 2009.
3. S Schultz, W Kunzler, Z Zhu, M Wirthlin, R Selfridge, A Propst, M Zikry and K Peters, "Full-spectrum interrogation of fiber Bragg grating sensors for dynamic measurements in composite laminates," *Smart Materials and Structures*, vol. 18, p. 115015, Sept. 2009.
4. J. Kvavle, S. S. Schultz, and R. H. Selfridge, "Low loss elliptical core D-fiber to PANDA fiber fusion splicing," *Opt. Expr.*, 2008.
5. T. L. Lowder, J. A. Newman, W. M. Kunzler, J. D. Young, R. H. Selfridge, and S. M. Schultz, "Temporal response of surface-relief fiber Bragg gratings to high temperature CO₂ laser heating," *Appl. Opt.*, vol. 47, 3568-3573, Jul. 2008.
6. R. Gibson, R. Selfridge, S. Schultz, W. Wang, and R. Forber, "Electro-optic sensor from high Q resonance between optical D-fiber and slab waveguide," *Appl. Opt.*, vol. 47, No. 13, p. 2234-2240, May 2008.
7. H. Liu, A. R. Hawkins, S. M. Schultz, and T. E. Oliphant, "Fast nonlinear image reconstruction for scanning impedance imaging," *IEEE Trans. Biomed. Eng.*, Vol. 55, 970-977, Mar. 2008.

8. J. D. Gordon, T. L. Lowder, R. H. Selfridge, and S. M. Schultz, "Optical D-Fiber based volatile organic compound sensor," *Appl. Opt.*, vol. 46, p. 7805-7810, Nov. 2007.
9. Brian G. Buss*, Daniel N Evans*, Hongze Liu, Tao Shang, Travis E Oliphant, Stephen M Schultz, and Aaron R Hawkins, "Quantifying Resistivity Using Scanning Impedance Imaging," *Sensors and Actuators: A. Physical*, vol. 137, p. 338-344, 2007.
10. E. K. Johnson, J. M. Kvavle, R. H. Selfridge, S. M. Schultz, R. Forber, W. Wang, and D. Y. Zang, "Electric field sensing with a hybrid polymer/glass fiber," *Appl. Opt.*, vol. 46, p. 6953-6958, Oct. 2007.
11. T. L. Lowder, R. H. Selfridge, and S. M. Schultz, "Surface relief D-fiber Bragg gratings for high-temperature and multidimensional bend sensing," *Materials Evaluation*, vol. 65, pp. 1042-1047, Oct. 2007.
12. B J Hansen, C J Carron, B D Jensen, A R Hawkins, and S M Schultz "Plastic latching accelerometer based on bistable compliant mechanisms," *Smart Materials and Structures*, vol. 16, p. 1967-1972, Oct. 2007.
13. T. L. Lowder, J. D. Gordon, S. M. Schultz, and R. H. Selfridge, "Volatile organic compound sensing using a surface-relief D-shaped fiber Bragg grating and a polydimethylsiloxane layer," *Opt. Lett.*, vol. 32, p. 2523-2525, Sep. 2007.
14. R. H. Selfridge, S. M. Schultz, and A. R. Hawkins, "Free-space optical link as a model undergraduate design project," *IEEE Trans. Educ.*, vol. 50, p. 208-215, Aug. 2007.
15. Hongze Liu, Aaron R. Hawkins, Stephen M. Schultz, and Travis E. Oliphant, "Verification and application of a finite-difference model for quasi-electrostatic scanning impedance imaging," *Electrostatics*, vol. 65, pp. 244-250, Apr. 2007.
16. Seth W. Lloyd, Jason A. Newman, Daniel R. Wilding, Richard H. Selfridge, and Stephen M. Schultz, "A fiber sensor integrated monitor for embedded instrumentation systems," *Rev. of Sci Instrum.*, vol. 78, pp. 35108, Apr. 2007.
17. Tyson L. Lowder, Brian R. Tebbs, Richard H. Selfridge, Stephen M. Schultz, "Polarization analysis of surface relief D-fiber Bragg gratings," *Appl. Opt.*, vol. 46, pp. 2387-2393, May 2007.
18. R. Gibson, J. Kvavle, R. Selfridge, and S. Schultz, "Improved sensing performance of D-fiber/planar waveguide couplers," *Opt. Express* **15**, 2139-2144 (2007)
<http://www.opticsinfobase.org/abstract.cfm?URI=oe-15-5-2139>
19. Travis E. Oliphant, Hongze Liu, Aaron Hawkins, and Stephen Schultz, "Simple linear models of scanning impedance imaging for fast reconstruction of relative conductivity of biological samples," *IEEE trans. Biomed. Eng.*, vol. 53, pp. 2323-2332, Nov. 2006.
20. K. H. Smith, B. L. Ipson, T. L. Lowder, A. R. Hawkins, R. H. Selfridge, and S. M. Schultz, "Surface relief fiber Bragg gratings for sensing applications," *Appl. Opt.*, vol. 45, 1669-1675, Mar. 2006.
21. K. J. Campbell, J. C. Morine, Z. A. George, C. P. Lusk, L. L. Howell, S. M. Schultz, and A. R. Hawkins, "Polymer Stretching to Produce Flat Suspended Micro-Membranes," *J. Microlith., Microfab., Microsyst.*, vol. 4, pp. 1-6, Oct. – Dec. 2005.
22. T. L. Lowder, K. H. Smith, B. L. Ipson, A. R. Hawkins, R. H. Selfridge, and S. M. Schultz, "High temperature sensing using surface relief fiber Bragg gratings," *IEEE Photon. Techn. Lett.*, vol. 17, pp. 1926-1928, Sep. 2005.
23. J. Henrie, E. Parsons, A. R. Hawkins, and S. M. Schultz, "Spectrum Sampling Reflectometer," *Surface Interface Analysis*, vol. 37, p. 568-572, Apr. 2005.

24. Aaron Hawkins, R. Wang, G. Sanber, J. Beutler, and S. Schultz, "Color Pictures Using Dielectric Films," *Color Res. and Appl.*, vol. 30, p. 125-129, Apr. 2005.
25. K. Smith, B. Ipson, R. Selfridge, and S. Schultz, "Versatile in-fiber sensing using core-replaced D-fiber," *Appl. Opt.*, Vol. 44, p. 22-26, Jan. 2005.
26. B. Green, T. Shang, J. Morine, H. Liu, S. Schultz, T. Oliphant, A. Hawkins, "Resolution scaling in noncontact scanning impedance imaging," *Rev. Sci. Instr.*, vol. 75, p. 4610-14, Nov. 2004.
27. J. Kvavle, C. Bell, J. Henrie, S. Schultz, and A. Hawkins, "Improvement to reflective dielectric film color pictures," *Opt. Expr.*, vol. 12, p. 5789-5794, Nov. 2004.
28. A. Hawkins, H. Liu, T. Oliphant, and S. Schultz, "Noncontact scanning impedance imaging in an aqueous solution," *Appl. Phys. Lett.*, vol. 85, p. 1080-1082, Aug. 2004.
29. J. Henrie, S. Kellis, S. Schultz, and A. Hawkins, "Electronic color charts for dielectric films on silicon," *Opt. Exp.*, vol. 12, pp. 1464-1469, Apr. 2004.
30. Kevin H. Smith, Doug J. Markos, Stephen M. Schultz, Richard H. Selfridge, Thomas D. Monte, and Richard B. Dyott, "Fabrication and analysis of a low-loss in-fiber polymer waveguide," *Appl. Opt.*, vol. 43, pp. 933-939, Feb. 2004.
31. Kevin H. Smith, Richard H. Selfridge, Stephen M. Schultz, Douglas J. Markos, and Benjamin L. Ipson, "Analysis of replacing and optical fiber core with polymer," *Opt. Exp.*, vol. 12, pp. 354-360, Feb. 2004.
32. Aaron R. Hawkins, Ran Wang, Mark Lowther, and Stephen M. Schultz, "Teaching Microfabrication Based Materials Processing Using Color Pictures From Dielectric Films," *Journal of Materials Education*, vol. 25, p. 179-188, (2003).
33. Douglas J. Markos, Benjamin L. Ipson, Kevin H. Smith, Stephen M. Schultz, Richard H. Selfridge, Thomas D. Monte, Richard B. Dyott, and Gregory Miller, "Controlled core removal from a D-shaped optical fiber," *Appl. Opt.*, vol. 42, pp. 7121-7125, Dec. 2003.
34. S. M. Schultz, E. N. Glytsis, and Thomas K. Gaylord, "Design, Fabrication, and Performance of Preferential-Order Volume Grating Waveguide Couplers," *Appl. Opt.*, vol. 39, p. 1223-1232, Mar 2000.
35. S. M. Schultz, E. N. Glytsis, and Thomas K. Gaylord, "Volume Grating Preferential-Order Focusing Waveguide Coupler," *Opt. Lett.*, vol. 24, p. 1708-1710, Dec. 1999.
36. S. M. Schultz, T. K. Gaylord, E. N. Glytsis, "Design of a High-Efficiency Volume Grating Coupler for Line Focusing," *Appl. Opt.*, vol. 37, p. 2278-2287, Apr. 1998.

CONFERENCE PROCEEDINGS

1. W. Kunzler, Z. Zhu, M. Wirthlin, R. Selfridge, S. Schultz, A. Propst, K. Peters, M. Zikry, "High repetition-rate full-spectrum interrogation of FBG sensors for dynamic measurements in composite laminates," *Proc. SPIE*, vol. 7293, Mar. 2009.
2. R. S. Gibson, R. H. Selfridge, S. M. Schultz, "Electric-field sensor array from cavity resonance between optical D-fiber and multiple slab waveguides," *Proc. SPIE* 7293, Mar. 2009.
3. W. Kunzler, J. Newman, D. Wilding, Z. Zixu, T. Lowder, R. Selfridge, and S. Schultz, "Advanced FBG sensing through rapid spectral interrogation," *Proc. SPIE*, vol. 6933, 69330D, Mar. 2008.
4. J. D. Young, T. L. Lowder, R. H. Selfridge, and S. M. Schultz, "Packaging of surface relief fiber Bragg gratings for harsh high temperature environments," *Proc. SPIE*, vol. 6933, p. 693308, Mar. 2008.

5. R. Gibson, R. Selfridge, S. Schultz, "Electro-optic sensor from high-Q resonance between optical D-fiber and slab waveguide," *Proc. CLEO*, p. 1-2, May 2008.
6. W. Kunzler, Z. Zhu, R. Selfridge, S. Schultz, M. Wirthlin, "Integrating fiber Bragg grating sensors with sensor networks," *Proc. IEEE AUTOTESTCON*, p. 354 – 359, Sep. 2008.
7. B. Todd, M. Phillips, S. Schultz, A. Hawkins, B. Jensen, "RFID threshold accelerometer," *IEEE AUTOTESTCON*, p. 55-59, Sept. 2008.
8. S. M. Schultz, "Teaching Fourier Optics using MATLAB," *Proc. SPIE*, vol. 6695, 2007. (invited paper)
9. W. Kunzler, J. Newman, D. Wilding, R. Selfridge, S. Schultz, and M. Wirthlin, "Accelerating an integrated FOS system for flight on a small UAV," *Proc. SPIE*, vol. 6530, Mar. 2007.
10. B. Hansen, C. Carron, S. Schultz, and A. Hawkins, "Zero-power shock sensors using bistable compliant mechanisms," *Proc. SPIE*, vol. 6525, Mar. 2007.
11. E. Johnson, R. Selfridge, and S. Schultz, "Electric field sensor based on core-replaced optical D-fiber," *Proc. SPIE*, vol. 6525, Mar. 2007.
12. J. Gordon, S. Schultz, and R. Selfridge, "In-situ monitoring of volatile organic compounds using a single-mode D-fiber and polydimethylsiloxane-evanescent field interaction," *Proc. SPIE*, vol. 6525, Mar. 2007.
13. T. Lowder, B. Tebbs, S. Schultz, and R. Selfridge, "Multi-axis bend sensing using a single surface relief fiber Bragg grating," *Optical Sensors Conference*, Oct. 2006.
14. J. Newman, S. Schultz, R. Selfridge, "A fiber sensor integrated monitor for embedded instrumentation systems," *Proc. Intern. Telem. Conf.*, Oct. 2006.
15. R. Forber, W. Wang, D.-Y. Zang, S. Schultz, and R. Selfridge, "Dielectric EM field probes for HPM test & evaluation," *Proc. ITEA Annual Technology Review*, Cambridge, MA, Aug. 2006.
16. S. Schultz and R. Selfridge, "An optical fiber sensor integrated monitor (FSIM)," *Proc. ITEA Annual Technology Review*, Cambridge, MA, Aug. 2006.
17. H. Liu, A. Hawkins, S. Schultz, T. Oliphant, "A Fast Linear Reconstruction Method for Scanning Impedance Imaging," in *Engineering in Medicine and Biology Society*, 2006. *EMBS '06. 28th Annual International Conference of the IEEE*, p. 4277-4280, New York, NY, Aug. 2006.
18. H. Liu, A. Hawkins, S. Schultz, T. Oliphant, "Microscopic impedance imaging of small tissues," in *IEEE Int. Symp. Biomed Imag. Nano Macro Proc.*, vol. 2006, p. 1084-1087, Apr. 2006.
19. W. C. Wang, H. Lotem, D. Zang, R. Forber, S. M. Schultz, R. H. Selfridge, "Dielectric ultra-wideband optical E-field sensors," *Proc. SPIE*, vol. 6219, Apr. 2006.
20. R. H. Selfridge, S. M. Schultz, T. L. Lowder, A. Mendez, V. P. Wnuk, S. Ferguson, T. W. Graver, "Packaging of surface relief fiber Bragg gratings for use as strain sensors at high-temperature," *Proc. SPIE*, vol. 6167, Feb. 2006.
21. T. L. Lowder, R. S. Gibson, K. H. Smith, R. H. Selfridge, S. M. Schultz, "Unique characteristics of surface relief fiber Bragg gratings and their application to multi-axis sensing," *Proc. SPIE*, vol. 6167, Feb. 2006.
22. S. W. Lloyd, J. Newman, E. Parsons, R. H. Selfridge, S. M. Schultz, "A fiber sensor integrated monitor for embedded instrumentation systems," *Proc. SPIE* 6167, Feb. 2006.

23. T. L. Lowder, K. H. Smith, B. L. Ipson, A. R. Hawkins, R. H. Selfridge, and S. M. Schultz, "Surface Relief Fiber Bragg Gratings with Application to High Temperature Sensing," OSA Annual Meeting, Tucson, AZ, Oct. 2005.
24. J. Henrie, A. Hawkins, S. Schultz, "Spectrum scanning reflectometer for thin-film metrology," SPIE, vol. 5878, p. I1-I11, Aug. 2005.
25. K. Price, Stephen Schultz, Richard Selfridge, "D-fiber Bragg gratings for sensors," JCIS Conference, Jul. 2005.
26. S. M. Schultz, "High Temperature Fiber Bragg Grating Sensors for Embedded Instrumentation," 2005 Annual ITEA Technology Review, Atlanta GA, July 2005.
27. K. H. Smith, B. L. Ipson, T. L. Lowder, A. R. Hawkins, R. H. Selfridge, S. M. Schultz, "Etched in-fiber gratings for temperature sensing at high temperatures," Proc. SPIE, vol. 5758, pp. 28-37, Mar. 2005.
28. K. H. Smith, B. L. Ipson, R. H. Selfridge, and S. M. Schultz, "Core Replaced D-Fiber Sensors for Structural Health Monitoring," AEROMAT, Seattle, WA, Jun. 2004.
29. B. Ipson, K. Smith, R. Selfridge, and S. Schultz, "Enhanced temperature sensing using in-fiber polymer waveguides," Proc. SPIE, vol. 5391, pp. 286-291, Mar. 2004.
30. K. J. Campbell, K. H. Smith, D. J. Markos, B. L. Ipson, S. M. Schultz, and R. H. Selfridge, "Fabrication of Structures onto the Flat Surface of a D-Shaped Optical Fiber", OSA Annual Meeting, Oct. 2003.
31. K. H. Smith, B. L. Ipson, D. J. Markos, K. J. Campbell, S. M. Schultz, and R. H. Selfridge, "Fabrication and Analysis of an In-fiber Polymer Waveguide," OSA Annual Meeting, Oct. 2003.
32. A. Mulè, S. M. Schultz, T. K. Gaylord, and J. D. Meindl, "An Optical Clock Distribution Network for Gigascale Integration," IEEE International Interconnect Technology Conference, Jun. 2000.
33. A. Mulè, S. M. Schultz, T. K. Gaylord, and J. D. Meindl, "A 10ghz Hybrid Optical/Electrical Clock Distribution Network for Gigascale Integration," LEOS Annual Meeting, Nov. 1999.
34. S. M. Schultz, T. K. Gaylord, and E. N. Glytsis, "High Efficiency Focusing Volume Grating Coupler," OSA Annual Meeting, Oct. 1999.
35. S. M. Schultz, T. K. Gaylord, and E. N. Glytsis, "High Efficiency Volume Grating Coupler," OSA Annual Meeting, Oct. 1998.
36. S. M. Schultz, T. K. Gaylord, and E. N. Glytsis, "Focusing Diffractive Coupler," OSA Annual Meeting, Oct. 1997.
37. S. M. Schultz, L. Harris, and R. Selfridge, "Two Step Input Coupler" in Proc. SPIE, vol. 2290, p. 98-104, Sep. 1994.

PATENTS

1. S. M. Schultz, "Segmented spectrum imaging system and method," US Patent, 7,391,388, Jun. 24, 2008.
2. A. Hawkins, T. Oliphant, S. Schultz, "Scanned impedance imaging system method and apparatus," US Patent, 7,205,782, Apr. 17, 2007.
3. T. Mule', C. Patel, J. Meindl, T. Gaylord, E. Glytsis, K. Martin, S. Schultz, M. Bakir, H. Reed, and P. Kohl, "Guided-wave optical interconnections embedded within a microelectronic wafer-level batch package," US Patent, 6,954,576, Oct. 11, 2005.
4. T. Mule', J. D. Meindl, P. Kohl, S. M. Schultz, T. K. Gaylord, E. N. Glytsis, R. Villalaz, M. Bakir, H. Reed, "Backplane, printed wiring board, and/or multi-chip module-level optical

interconnect layer having embedded air-gap technologies and methods of fabrication,” US Patent, 6,788,867, Sept. 7, 2004.

5. S. M. Schultz, D. L. Barker, H. A. Schmitt, “Radome compensation using matched negative index of refraction materials,” US Patent, 6,788,273, Sep. 7, 2004.
6. T. Mule', C. Patel, J. D. Meindl, T. K. Gaylord, E. N. Glytsis, K. P. Martin, S. M. Schultz, M. Bakir, H. Reed, and P. Kohl, “Guided-wave optical interconnections embedded within a microelectronics wafer-level batch package,”, US Patent, 6,785,458, Aug. 31, 2004.
7. D. L. Barker, S. M. Schultz, H. A. Schmitt, “Microwave absorbing material,” US Patent, 6,756,932, June 29, 2004.
8. D. L. Barker, H. A. Schmitt, S. M. Schultz, “Optical accelerometer and its use to measure acceleration,” US Patent, 6,567,174, May 20, 2003.
9. D. L. Barker, H. A. Schmitt, D. J. Knapp, D. Braunreiter, A. A. Samuel, S. M. Schultz, “Far field emulator for antenna calibration,” US Patent, 6,531,989, March 11, 2003.
10. S. M. Schultz, T. K. Gaylord, E. N. Glytsis, N. F. Hartman, “Diffractive grating coupler and method,” US Patent, 6,285,813, Sept. 4, 2001.

PROFESSIONAL ACTIVITIES

Research Funding

| Project Name | Period | Funding Source | Role | Total Grant |
|--|---------------|------------------------------------|-------------|--------------------|
| Electric Field Sensor System | 2009 | ONR | PI | \$35k |
| Full spectral interrogation of fiber Bragg grating sensors for damage identification | 2009-2012 | National Science Foundation | PI | \$148k |
| Advanced Polymer Optical Sensors (APOS) | 2008-2010 | IPITEK | PI | \$329k |
| MRI: Acquisition of chlorine based reactive ion etcher | 2007 | National Science Foundation | Co-PI | \$300k |
| D-fiber sensors in harsh environments | 2007-2009 | Office of the Secretary of Defense | PI | \$356k |
| D-fiber surface relief gratings | 2006-2007 | Harris Corporation | PI | \$35k |
| Impedance measurement of micro-fluidic channels | 2006 | BYU | Co-PI | \$15k |
| Impedance Measurement of Micro-Fluidic Channels | 2006 - 2007 | BYU | Co-PI | \$12k |
| Compact integrated monitoring system for fiber sensors | 2004-2005 | Office of the Secretary of Defense | PI | \$164 |
| MEMS display elements based on optical interference | 2004-2005 | BYU | PI | \$5k |

| Project Name | Period | Funding Source | Role | Total Grant |
|---|---------------|------------------------------------|-------------|--------------------|
| An optical fiber high-speed survivable transducer for high power microwaves | 2004-2007 | Office of the Secretary of Defense | PI | \$297k |
| Nanosopic Imaging Based on Optical Tomography | 2003 | BYU | Co-PI | \$10k |
| D-fiber for multidimensional sensor applications | 2003-2004 | Office of the Secretary of Defense | PI | \$116k |
| IMMERSE – Intensive Mentoring and Research in Micro-Electronics for Students in Engineering | 2003 - 2008 | BYU | PI | \$100k |
| D-fiber Tunable Filters | 2002-2003 | BYU | PI | \$14k |
| Phase Mask Recording of Diffractive Components | 2002-2003 | BYU | PI | \$11k |
| | | | | \$1.9 M |

Undergraduate Research Program

Together with Prof. Aaron Hawkins of BYU's Electrical and Computer Engineering Department, I initiated the Intensive Mentoring and Micro-Electronic Research for Students in Engineering (IMMERSE) program in 2003. Its goal is to prepare students for entry into top tier graduate programs and provide them an opportunity to author or co-author a technical paper. Each year approximately 15 undergraduate students participate in the program that involves one-on-one training by faculty and senior students, imbedding students into existing research projects, and assigning each student an independent project. Students are offered full time employment in the summer and part time employment during the school year. Funding is provided by an existing BYU mentoring program, MICRON Corp., and through external research grants.

IMMERSE Highlights:

- 71 Students employed since 2003
- > 80% of students have authored or co-authored a technical paper
- > 75% of students have pursued graduate degrees

<http://www.ece.byu.edu/ugresearch>

Web Based Reference Tools

An effort was begun in 2003 to provide on-line instructions for the tools in BYU's cleanroom facility, the Integrated Microfabrication Laboratory. This work rapidly expanded to include basic reference information on semiconductors, microfabrication, and equipment operation, including tutorials and interactive calculators and graphs. This information is now contained at

the following website: www.ee.byu.edu/cleanroom and contains over 250 separate pages of information. The site receives over 50,000 hits per month from external visitors who use it as an essential reference. A companion site was launched in 2005 dedicated to providing reference information on photonics topics: www.ee.byu.edu/photonics. This site contains over 100 separate pages and receives 20,000 hits per month from external visitors. Prof. Stephen Schultz and I oversee the continued expansion and improvement of these two sites. Most of the HTML coding is done by students participating in our IMMERSE program.