Gary L. Woods
Curriculum Vitae
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2526 Goldsmith St.
Houston TX 77030
gary.woods@rice.edu
713-775-2775 (mobile)

Rice University ECE Dept.
6100 S. Main St. MS 366
Houston TX 77005
713-348-3598 (office)

Education

Stanford University: Ph.D. Applied Physics, 1997 (M.S. 1991)
> Advisor: Prof. Martin M. Fejer
> National Science Foundation Graduate Fellowship
> Dissertation title: *Nonlinear Optical Waveguide Devices Utilizing Intersubband Transitions in III-V Semiconductor Quantum Wells*

Rice University: BSEE & BA Physics, *cum laude*, 1988
> Fulfilled requirements for BS in Physics. Phi Beta Kappa, Eta Kappa Nu, Tau Beta Pi, more; George R. Brown Forensics Society, debate team captain; National Merit Scholar; Sid Richardson College Fellow & Athenian Award.

Employment

2008-present*: Professor in the Practice in Computer Technology*, Dept. of Electrical & Computer Engineering, Rice University, Houston, TX. (*Distinguished Professor in the Practice* since 2020).

2006-present: *Consultant*, specializing in debug of integrated circuits and design of optical and electronic systems; Sunnyvale, CA and Houston, TX.

2003-2006: *Senior Scientist*, Credence Systems Corp., Diagnostics and Characterization Group, Sunnyvale, CA (originally Optonics Inc., acquired by Credence in 2003).

2000-2002: *Chief Technical Officer & co-founder*, Spectralane, Inc., Santa Clara, CA

1998-2000: *Senior Researcher*, Intel Corp., Santa Clara, CA

1996-1998: *Postdoctoral Fellow*, University of California, ECE Dept. & Quest Center, Santa Barbara, CA

1988-1989 *Member of Technical Staff*, Texas Instruments Corp. Dallas, TX (summers)

1987 *Undergraduate research asst.*, Rice University ECE dept. Houston, TX (summer)

1985-1986 *Computer programmer*, US Dept. of Energy, Bartlesville, OK (summers)

1984 *Computer operator*, Phillips Petroleum Company, Bartlesville, OK (summer)

Educational programs & university courses taught

1. "Senior Design Lab" (Elec 494), ECE Dept., Rice University. AY2009-present. Yearlong 2-3 credit "capstone" course for all graduating seniors. Mentored approx. 10 senior teams each year. Co-created interdisciplinary "collaborative capstone" course across ECE, BioEngineering and Mechanical Engineering. Many senior teams won state, national, and international awards in areas ranging from electrical engineering to global health. Every project in my course, every year, has had a working prototype by spring. My teams have won numerous national and international awards.

2. "Introduction to Physical Electronics" (Elec 305), ECE Dept., Rice University. F'08, F'09, F'10; S'11-S'19. A 3-credit junior-level lecture course on semiconductor devices (FETs, ICs, BJTs, etc.), transmission lines, and antennas. The course was consistently ranked among the best ECE courses by Rice ECE undergrads.

3. "Fundamentals of Electrical Engineering II Lab" (Elec 244), ECE Dept., Rice University, S'15, S'20. New laboratory course for sophomores covering basics of circuits (RLC, discrete transistors, opamps, PWM, class D amplifiers, control with digital hardware in the loop.). After lockdown, distributed parts kits & scope dongles to enable circuit construction by students at home.

4. "Electronic Measurement Systems" (Elec 243), ECE Dept., Rice University, S'20. Co-taught. A circuits course for non-majors, a core course for sophomores in the Dept. of BioEngineering at Rice. Developed and administrated new lab assignments.

5. "Basic Electronics" (F'19), a 3-hour workshop on introductory electronics taught to about 100 engineering freshmen. Developed from scratch and funded with an internal grant. Equipment purchased includes ADALM2k USB dongle which now supports general activities in the Oshman Engineering Design Kitchen (OEDK).

6. "Fundamentals of Electrical Engineering I Laboratory" (Elec 240), ECE Dept., Rice University, F'18, F'20. A one credit course companion to the core Elec 241 Fundamentals of EE course. Adapted from the MOOC which I helped to develop (see below.)

7. "Survey of Engineering Disciplines" (Engi 150), ECE Dept., Rice University, F'16. A one-credit seminar for freshmen to expose them to types of careers open to engineers.

8. "Introduction to Embedded Programming" (Elec 497), ECE Dept., Rice University, S'13, S'14, F'14, F'15, F'16. F'17. Zero/one-credit course on microcontroller programming in C and PCB design for senior design teams without an ECE student Developed "Escape Platform" embedded programming PCB and software base for teaching purposes.

9. "Fundamentals of Electrical Engineering Laboratory", Massive Open Online Course (MOOC) offered through Coursera, Spring '14. Assisted with development of laboratory assignments and parts kit. This was one of the first MOOCs ever to offer a laboratory component through a parts kit purchased separately by enrollees.

10. "Fundamentals of Electrical Engineering II Lab" (Elec 242), ECE Dept., Rice University, S'14. Developed a stand-alone set of laboratory exercises for the 4-credit course. Spun out as a separate course (Elec 244) in Spring '15.

11. "Analog Circuits Lab" (Elec 342), ECE Dept., Rice University, S'09, S'10, F'11. Developed a new 4-credit lab course on intermediate analog circuits (amplifiers, FETS & BJTs, small signal models, feedback, audio power amplifiers, PCB design.) Course culminated in design and construction of audio power and amplifier on a PCB.

12. "Project Management and Professional Issues" (Elec 394), ECE Dept., Rice University, S'10, S'11, S'12. 2-credit course on project management, career choices, professional interactions, and intellectual property.

13. "Semiconductor device physics in 4 hours," an original half-day lecture course covering device physics from p-n junctions through FETs. Presented at Credence Systems Corp., Feb. 2007.

14. "Design Debug," an original 3-day lecture + laboratory course on techniques for debug of IC designs, offered through Semitracks, Inc. Presented at U.S. Dept. of Defense, June 2007. See http://www.semitracks.com/courses/design/design-debug.php

Honors

- *George R. Brown Award for Superior Teaching*, April 2016 & April 2019. Awarded annually to the top 10 instructors out of about 600 at Rice University, based on input from recent students.

- *George R. Brown Award for Superior Teaching*, April 2018 & April 2021. Finalist (one of top 25 but not one of top 10).
- *Hudspeth Award,* April 2019. Awarded by Rice Office of Student Activities to the top advisors of student clubs.

Rice academic service and responsibilities

- *Member of ECE undergraduate committee* 2008-present, Chair AY20-21. Inputs on curricular changes and ABET readiness. Developed new senior design (capstone) course structure. Developed new curricular structure to support Vertically Integrated Projects (VIP).
- *Member, Faculty Committee* Engineering Design Minor, 2016 – present. Oversight of policies supporting the new Engineering Design Minor.
- *Faculty Sponsor, Rice Electric Vehicle Club*, 2016-present. Starting in AY '18-'19 I made the REV part of my Vertically Integrated Projects (VIP) team. They successfully completed the Shell Eco Marathon course for the first time in about 5 years.
- *Academic advisor,* Engineering Design Minor, 2016-present. Advised students pursuing or considering the Engineering Design Minor.
- *School of Engineering Curriculum Review Committee,* F'18-present. (Chair AY'18-'19). Reviewed proposed courses within SoE for credit-worthiness. As Chair, tried to convince 7 tenured/ tenure-track faculty members to perform a 30-minute task using only constant hectoring and guilt as motivators.
- *Coordinator of Vertically Integrated Projects in ECE Dept.*, 2014-present. Developed course content for VIP projects. VIP projects involved about 10-12 undergrads along with grad students, postdocs and PIs. Program is currently being expanded to 5 departments in two schools.
- *ECE Undergraduate academic advising*, 2008-present. Responsibility for curricular and career advice for about 1/3 of Rice ECE majors.
- *Oversight of ECE undergraduate teaching lab,* 2014-present. Developed and drove implementation of plan to update and modernize equipment in the lab where core circuits courses are taught for all ECE majors and non-majors.
- *Chair of ECE undergraduate awards committee,* 2013-2014 -- responsibility for nominating students for Rice awards.
- *Divisional Advisor* for Sid Richardson (residential) College, 2010-2019; for Duncan (residential) College, F'19-present. responsibility for advising Freshmen and Sophomores majoring in any Engineering discipline.
- *First-Year Mentor and Faculty Associate,* Sid Richardson (residential) College, 2009-2019; for Duncan (residential) College, F'19-present. Social interactions with students, informal advising of individuals, occasional meetings with freshman groups, frequent lunches, etc.
- *Mentoring of Freshman design teams,* AY 2010-11 -present. Mentored 1-2 freshman design teams in Engi 120 (Intro to Engineering Design) course in all but one semester.
- *OEDK "office hours"* – 2014-present. For 2-3 weeks before the Engineering Design Showcase in April each year, I make myself available from 10PM- 12AM nearly every evening to provide assistance with electronic design & troubleshooting for any team.

Grants and awards

1. G. Woods, F. Li, D. Subramanian, L. Duenas-Osorio, "Scalable and Robust Prototype of Sensor Network for Real-Time Street-Level Flood Measurement", Houston Solutions Lab grant, $73K, AY 2018-19.

2. G. Woods, R. Ramos, L.Yu, , "Creating a Curricular Scaffolding Structure to Evaluate and Enhance Performance of Vertically Integrated Projects," Rice University Quality Enhancement Program on the Scaffolding Experiential Inquiry and Research in the Curriculum, $30K, AY 2018-19.

3. G. Woods, R. Simar, "Enhancing Experiential Learning in Design of Electronics", Rice University Quality Enhancement Program on the Scaffolding Experiential Inquiry and Research in the Curriculum, $30K, AY 2017-18.

4. G. Woods, "Freshman Seminar -- Survey of Engineering Disciplines," Rice University Excellence in Engineering Education grant, $7K, AY 2016-17.

5. G. Woods, "Integrated Electronics Ecosystem for the OEDK", Rice University Brown Foundation Teaching Grant, $5K, 2016.

6. B. Aazhang, J. Cavallaro, G.L. Woods, on sub-award via Georgia Tech from Helmsley Foundation for establishing Vertically Integrated Projects among members of the international VIP Consortium. Jan 2014-present. Amount due to Rice is about $130,000 over 3 years.

7. J. Cavallaro, G.L. Woods, National Space Grant Foundation Award # Xhab 2014-03, "SpaceRing: A Versatile, Scalable Power-Generation and Cooling System For Deep-Space Habitats", (co-PI). $20,000.

8. J. Kono, G. Woods, R. Vaitai, (co-PI) "RAMSES: Repetitive advanced magnet for student experiments and science international senior design project," Rice Faculty Initiatives Fund, 2013, $20,000.

9. G.L. Woods, M.K. O'Malley, Z.M. Oden, (PI) "Course Module on Embedded Electronics Systems for Multidisciplinary Senior Design Proejcts", Rice University Brown Foundation Teaching Grant, 2012, $5000

10. G.L. Woods, K. Kelly, "Vivid Demonstrations of Concepts in Physical Electronics," Rice University Brown Foundation Teaching Grant, 2011, $4000.

11. F. Koushanfar, S. Reda, G.L. Woods, "Algorithmic Techniques for Post-Silicon Characterization Using Infrared Emissions" (co-PI). NSF #1116858, $260,000, 2011-2014

Other activities

Member of Technical Advisory Board and co-founder, 2009-present*:* InView Technology Corp., Austin TX. Advisor to startup company seeking to commercialize compressive-sensing technology developed at Rice for the application of non-visible camera systems. Developed an analog optoelectronic front end with 100x performance improvement over commercial systems.

Consultant, 2006-present.

- Advising semiconductor companies on optical probing related to debugging integrated circuits. Several successful "debug wins," helping to accelerate product-launch dates.

- Expert witness in 6 federal cases (3 trade secret, 3 patent) involving integrated circuits, PCB design, and RF design.

Publications & Patents

Journal Articles

1. G. Timothy Noe, G. Timothy Noe, Ikufumi Katayama, Fumiya Katsutani, James J. Allred, Jeffrey A. Horowitz, David M. Sullivan, Qi Zhang, Fumiya Sekiguchi, Gary L. Woods, Matthias C. Hoffmann, Hiroyuki Nojiri, Jun Takeda, and Junichiro Kono, "Single-shot terahertz time-domain spectroscopy in pulsed high magnetic fields, " *Optics Express*, vol. 24 (26), p. 30328 (2016).

2. G. Timothy Noe, Qi Zhang, Joseph Lee, Eiji Kato, Gary L. Woods, Hiroyuki Nojiri, and Junichiro Kono, "Rapid scanning terahertz time-domain magnetospectroscopy with a table-top repetitive pulsed magnet," Applied Optics vol. 53 (26), p. 5850 (2014).

3. G.T. Noe II, H. Nojiri, J. Lee, <u>G.L. Woods</u>, J. Léotin, J. Kono, "A table-top, repetitive pulsed magnet for nonlinear and ultrafast spectroscopy in high magnetic fields up to 30T", *Review of Scientific Instruments* vol. 84 (12) p. 123906, 2013.

4. D.T. Morris, C.L. Pint, R. S. Arvidson, A. Lüttge, R.H. Hauge, A.A. Belyanin, <u>G.L. Woods</u>, J. Kono, "Midinfrared third-harmonic generation from macroscopically aligned ultralong single-wall carbon nanotubes," *Phys. Rev. B* vol. 87 (16), p.161405, 2013.

5. Z. M. Oden, M. K. O'Malley, <u>G. Woods</u>, T. Kraft, B. Burke, "Outcomes of Recent Efforts at Rice University to Incorporate Entrepreneurship Concepts into Interdisciplinary Capstone Design," *International Journal of Engineering Education*, vol. 28, no 2., pp.1-5, 2012.

6. U. Kindereit, <u>G. Woods</u>, J. Tian, U. Kerst, R. Leihkauf, and C. Boit, "Quantitative Investigation of Laser Beam Modulation in Electrically Active Devices as Used in Laser Voltage Probing," *IEEE Transactions on Device and Materials Reliability,* vol. 7, pp. 19-30, 2007.

7. J. Y. Liao, <u>G. L. Woods</u>, and H. L. Marks, "Rapid diagnostics of ASIC circuit marginalities using dynamic laser stimulation," *IEEE Transactions on Device and Materials Reliability,* vol. 6, pp. 9-16, 2006.

8. <u>G. L. Woods</u>, P. Papaparaskeva, M. Shtaif, I. Brener, and D. A. Pitt, "Reduction of Cross-Phase Modulation-Induced Impairments in Long-Haul WDM Telecommunication Systems Via Spectral Inversion," *IEEE Photonics Technology Letters,* vol. 16, pp. 677-9, 2004.

9. A. Imamoglu, H. Schmidt, <u>G. Woods</u>, and M. Deutsch, "Strongly interacting photons in a nonlinear cavity," *Physical Review Letters,* vol. 79, pp. 1467-70, 1997.

10. H. C. Chui, <u>G. L. Woods</u>, M. M. Fejer, E. L. Martinet, and J. S. Harris, Jr. "Tunable mid-infrared generation by difference frequency mixing of diode laser wavelengths in Intersubband InGaAs/AlAs quantum wells," *Applied Physics Letters,* vol. 66, pp. 265-7, 1995.

11. E. L. Martinet, H. C. Chui, <u>G. L. Woods</u>, M. M. Fejer, J. S. Harris, Jr., C. A. Rella, B. A. Richman, and H. A. Schwettman, "Short wavelength (5.36-1.85   m) nonlinear spectroscopy of coupled InGaAs/AlAs Intersubband quantum wells," *Applied Physics Letters,* vol. 65, pp. 2630-2, 1994.

12. H. C. Chui, E. L. Martinet, <u>G. L. Woods</u>, M. M. Fejer, J. S. Harris, Jr., C. A. Rella, B. I. Richman, and H. A. Schwettman, "Doubly resonant second harmonic generation of 2.0 mm light in coupled InGaAs/AlAs quantum wells," *Applied Physics Letters,* vol. 64, pp. 3365-7, 1994.

13. H. C. Chui, E. L. Martinet, <u>G. L. Woods</u>, M. M. Fejer, J. S. Harris, Jr., C. A. Rella, B. I. Richman, and H. A. Schwettman, "Doubly resonant second harmonic generation of 2.0um light in coupled InGaAs/ AlGaAs quantum wells," *Applied Physics Letters,* vol. 64, 1994.

14. L. Gordon, <u>G. L. Woods</u>, R. C. Eckardt, R. R. Route, R. S. Feigelson, M. M. Fejer, and R. Byer, "Diffusion-bonded stacked GaAs for quasiphase-matched second-harmonic generation of a carbon dioxide laser," *Electronics Letters,* vol. 29, pp. 1942-4, 1993.

Conference papers and presentations

1. Z.M. Oden, E. Richardson, <u>G. Woods</u>, A. Dick, M. O'Malley, "A model for a successful collaborative capstone design course," paper P-Th-670, *Biomedical Engineering Society Annual Meeting*, 2014.

2. G.T. Noe II, Q. Zhang, J. Lee, E. Kato, H. Nojiri, <u>G. Woods</u>, J. Kono, "Terahertz Time-Domain Magnetosectroscopy using a Table-Top Repetitive Pulsed Magnet", *CLEO:QELS_Fundamental Science*, 2014.

3. A.M. Andalcio, P. Breen, L.A. Hendricks, T.J. Sarkar, G.T. Noe, <u>G.L. Woods</u>, J. Kono, and J. Leotin, "Compact single-shot terahertz time-domain spectroscopy system for magneto-optics with a mini-coil pulsed magnet," *International Conference on Infrared, Millimeter and Terahertz Waves (IRMMW-THz) Conference*, 2013.

4. K. Dev, <u>G. Woods</u>, S. Reda, "High-throughput TSV testing and characterization for 3D integration using thermal mapping," in *Design Automation Conference*, 2013.

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