

Stanford



Thomas Lee

Professor of Electrical Engineering

Bio

BIO

Professor Lee's principal areas of professional interest include analog circuitry of all types, ranging from low-level DC instrumentation to high-speed RF communications systems. His present research focus is on CMOS RF integrated circuit design, and on extending operation into the terahertz realm.

ACADEMIC APPOINTMENTS

- Professor, Electrical Engineering

PROGRAM AFFILIATIONS

- Stanford SystemX Alliance

PROFESSIONAL EDUCATION

- ScD, MIT (1990)

LINKS

- <http://smirc.stanford.edu/people.html>: <http://smirc.stanford.edu/people.html>

Teaching

COURSES

2025-26

- Advanced Circuit Techniques: EE 308 (Spr)
- High-Frequency Circuit Design Laboratory: EE 251 (Win)
- Things about Stuff: EE 14N (Aut)

2024-25

- Advanced Circuit Techniques: EE 308 (Spr)
- High-Frequency Circuit Design Laboratory: EE 251 (Win)
- Things about Stuff: EE 14N (Aut)

2023-24

- Advanced Circuit Techniques: EE 308 (Spr)
- Circuits II: EE 101B (Spr)
- High-Frequency Circuit Design Laboratory: EE 251 (Win)

- Things about Stuff: EE 14N (Aut)

2022-23

- Advanced Circuit Techniques: EE 308 (Spr)
- An Intro to Making: What is EE: ENGR 40M (Aut)
- High-Frequency Circuit Design Laboratory: EE 251 (Win)
- Things about Stuff: EE 14N (Aut)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Clarissa Daniel, West Foster, Malachi Hornbuckle, Jeongkyu Kim, Yuya Nishio, Victor Turbiner, Yu-Neng Wang

Postdoctoral Faculty Sponsor

Richelle Smith

Doctoral Dissertation Advisor (AC)

Zongru Li, Tejus Rao

Master's Program Advisor

Nicolas Coleman, Ankush Dhawan, Ivan Kuo, Micha Rand, Fengrui Zuo

Doctoral (Program)

George Alexopoulos, West Foster, Oliver Pranis, Tejus Rao

Publications

PUBLICATIONS

- **Input-Independent and Power-Efficient Time-Interleaved ADC Calibration Using Adaptive Kuramoto Synchronization** *ELECTRONICS*
Lee, D., Smith, R. L., Lee, T. H.
2026; 15 (4)
- **Equalization and Coding Techniques for Edge Modulation Signaling** *IEEE OPEN JOURNAL OF CIRCUITS AND SYSTEMS*
Smith, R. L., Mahmood, S., Werner, C. W., Lee, T. H., Hossain, M.
2026; 7: 105-118
- **Computing Max 3-Cut With CMOS Tripolar Oscillatory Cellular Neural Networks** *IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS II-EXPRESS BRIEFS*
Smith, R. L., Lee, T. H.
2025; 72 (12): 2032-2036
- **OscNet: Machine Learning on CMOS Oscillator Networks** *IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS II-EXPRESS BRIEFS*
Cai, W., Li, Z., Lee, T. H.
2025; 72 (7): 908-912
- **Inherent stochasticity, noise and limits of detection in continuous and time-gated fluorescence systems.** *PLoS ONE*
Vitale, N. H., Hassibi, A., Soh, H. T., Murmann, B., Lee, T. H.
2024; 19 (12): e0313949
- **Quantum Computing Gate Emulation Using CMOS Oscillatory Cellular Neural Networks** *IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS II-EXPRESS BRIEFS*
Smith, R. L., Lee, T. H.
2024; 71 (10): 4541-4545
- **Differential Edge Modulation Signaling for Low-Energy, High-Speed Wireline Communication** *IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS I-REGULAR PAPERS*

Smith, R. L., Hossain, M., Werner, C. W., Kahn, J. M., Lee, T. H.
2023

- **Polychronous Oscillatory Cellular Neural Networks for Solving Graph Coloring Problems** *IEEE OPEN JOURNAL OF CIRCUITS AND SYSTEMS*
Smith, R. L., Lee, T. H.
2023; 4: 156-164
- **Analysis and Design of a Tetrahedral Oscillator** *IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS II-EXPRESS BRIEFS*
Smith, R. L., Lee, T. H.
2022; 69 (1): 75-79
- **Hybrid Analysis and Simulation Methodology for Noise in Active Mixers**
Smith, R. L., Lee, T. H., IEEE
IEEE.2022
- **Hybrid Frequency Domain Simulation Method to Speed-up Analysis of Injection Locked Oscillators**
Smith, R. L., Lee, T. H., IEEE
IEEE.2021: 722-726
- **Modeling of Injection Locking in Neurons for Neuromorphic and Biomedical Systems**
Smith, R. L., Lee, T. H., IEEE
IEEE.2021
- **An Electronically Steerable Millimeter-Wave Reflectarray for Wireless Power Delivery**
Buckmaster, J., Lee, T. H., IEEE
IEEE.2020
- **A Simple Linear Time-Variant Theory of Superregeneration**
Raghunathan, A., Lee, T. H., IEEE
IEEE.2020
- **An Electronically Steerable Millimeter-Wave Reflectarray for Wireless Power Delivery**
Buckmaster, J., Lee, T. H., IEEE
IEEE.2020
- **An Electronically Steerable Millimeter-Wave Reflectarray for Wireless Power Delivery**
Buckmaster, J., Lee, T. H., IEEE
IEEE.2020: 514-517
- **Evaluating the Microwave Performance of Epidermal Electronics with Equivalent Transmission Line Modeling**
Chang, T., Fan, J. A., Lee, T. H., IEEE
IEEE.2018
- **A 125 pJ/bit 5 mW 28 GHz Superregenerative Receiver with Automatic Gain Control and Energy Efficient Startup for Burst Mode IoT Applications**
Raghunathan, A., Lee, T. H., IEEE
IEEE.2018: 70-73
- **A Ka-Band Beamformer for Wireless Power Transfer to Body Area Networks**
Saiz, N. D., Buckmaster, G., Lee, T. H., IEEE
IEEE.2018: 10-12
- **A Ka-Band Beamformer for Wireless Power Transfer to Body Area Networks**
Saiz, N. D., Buckmaster, G., Lee, T. H., IEEE
IEEE.2018
- **Evaluating the Microwave Performance of Epidermal Electronics with Equivalent Transmission Line Modeling**
Chang, T., Fan, J. A., Lee, T. H., IEEE
IEEE.2018: 40-42

- **A General Strategy for Stretchable Microwave Antenna Systems using Serpentine Mesh Layouts** *ADVANCED FUNCTIONAL MATERIALS*
Chang, T., Tanabe, Y., Wojcik, C. C., Barksdale, A. C., Doshay, S., Dong, Z., Liu, H., Zhang, M., Chen, Y., Su, Y., Lee, T. H., Ho, J. S., Fan, et al
2017; 27 (46)
- **Characterization of Stretchable Serpentine Microwave Devices for Wearable Electronics**
Chang, T., Wojcik, C., Su, Y., Rogers, J. A., Lee, T. H., Fan, J. A., IEEE
IEEE.2017: 207–10
- **A Phase-Interpolation and Quadrature-Generation Method Using Parametric Energy Transfer in CMOS** *IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS I-REGULAR PAPERS*
Bhardwaj, K., Lee, T. H.
2015; 62 (5): 1250-1259
- **GPS Anti-Jam: A Simple Method of Single Antenna Null-Steering for Aerial Applications**
McMilin, E., De Lorenzo, D. S., Lee, T., Enge, P., Akos, D., Caizzone, S., Konovaltsev, A., Inst Navigat
INST NAVIGATION.2015: 470–83
- **Terahertz CMOS Integrated Circuits** *IEEE International Symposium on Radio-Frequency Integration Technology (RFIT) - Silicon Technology Heats up for THz*
Lee, T. H.
IEEE.2014
- **Terahertz Electronics: The Last Frontier**
Lee, T. H.
edited by Bez, R., Pavan, P., Meneghesso, G.
IEEE.2014: 30-34
- **A 0.96mW, 5.3-6.75GHz, Phase-Interpolation and Quadrature-Generation Method using Parametric Energy Transfer in 65nm CMOS**
Bhardwaj, K., Lee, T. H., IEEE
IEEE.2014: 2145–48
- **Single Antenna GPS Spoof Detection that is Simple, Static, Instantaneous and Backwards Compatible for Aerial Applications**
McMilin, E., De Lorenzo, D. S., Walter, T., Lee, T. H., Enge, P., Inst Navigat
INST NAVIGATION.2014: 2233–42
- **Micro Barkhausen-Kurz Oscillators for Terahertz Integrated Systems** *15th IEEE International Vacuum Electronics Conference*
Dixit, A., Snapp, J. P., Lee, T. H.
IEEE.2014: 69–70
- **Terahertz Electronics: The Last Frontier** *40th European Solid-State Circuit Conference (ESSCIRC)*
Lee, T. H.
IEEE.2014: 30–34
- **Terahertz Electronics: Opportunities, Challenges and Technologies**
Lee, T., IEEE
IEEE.2013
- **A 3.1mW Phase-Tunable Quadrature-Generation Method for CEI 28G Short-Reach CDR in 28nm CMOS**
Bhardwaj, K., Narayan, S., Shumarayev, S., Lee, T., IEEE
IEEE.2013: 412-+
- **Dark Secrets of RF Design** *IEEE Solid-State Circuits Society Singapore Chapter, Singapore*
Lee, T.
2012
- **Circuit-Based Characterization of Device Noise Using Phase Noise Data** *IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS I-REGULAR PAPERS*
Navid, R., Lee, T. H., Dutton, R. W.
2010; 57 (6): 1265-1272

- **CMOS Impedance Biosensor Array with Active Tone Cancellation for Simultaneous Impedance and Nonlinearity Measurement** *International Instrumentation and Measurement Technology Conference (I2MTC)*
Daniels, J. S., Anderson, E. P., Pourmand, N., Lee, T. H.
IEEE.2010
- **The Return of the Empty State: Vacuum Nanoelectronics for Terahertz Applications**
Lee, T.
2010
- **A 10Gb/s NRZ Receiver with Feedforward Equalizer and Glitch-Free Phase-Frequency Detector** *35th European Solid-State Circuits Conference (ESSCIRC 2009)*
Kiaei, A., Bohsali, M., Bahai, A., Lee, T. H.
IEEE.2009: 373–376
- **When Silicon Valley was ‘Arc Alley**
Lee, T.
2009
- **European Solid-State Circuits Conference, Athens, Greece**
Kiaei, A., Bohsali, M., Bahai, A., Lee, T., H.
2009
- **Crosstalk in Integrated Microarrays With Current Sensing** *IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS I-REGULAR PAPERS*
Anderson, E. P., Daniels, J. S., Pourmand, N., Lee, T. H.
2008; 55 (11): 3756-3762
- **High-speed optical beam-steering based on phase-arrayed waveguides** *52nd International Conference on Electron, Ion and Photon Beam Technology and Nanofabrication*
Jarrahi, M., Fabian, R., Pease, W., Miller, D. A., Lee, T. H.
A V S AMER INST PHYSICS.2008: 2124–26
- **Optical spatial quantization for higher performance analog-to-digital conversion** *IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES*
Jarrahi, M., Fabian, R., Pease, W., Miller, D. A., Lee, T. H.
2008; 56 (9): 2143-2150
- **Spatial Quantized Analog-to-Digital Conversion Based on Optical Beam-Steering** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
Jarrahi, M., Pease, R. F., Lee, T. H.
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- **Wideband, low driving voltage traveling-wave Mach-Zehnder modulator for RF photonics** *IEEE PHOTONICS TECHNOLOGY LETTERS*
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- **A system for multiplexed direct electrical detection of DNA synthesis** *SENSORS AND ACTUATORS B-CHEMICAL*
Anderson, E. P., Daniels, J. S., Yu, H., Karhanek, M., Lee, T. H., Davis, R. W., Pourmand, N.
2008; 129 (1): 79-86
- **A System for Multiplexed Direct Electrical Detection of DNA Synthesis.** *Sensors and actuators. B, Chemical*
Anderson, E. P., Daniels, J. S., Yu, H., Karhanek, M., Lee, T. H., Davis, R. W., Pourmand, N.
2008; 129 (1): 79-86
- **Optical switching based on high-speed phased array optical beam steering** *APPLIED PHYSICS LETTERS*
Jarrahi, M., Fabian, R., Pease, W., Miller, D. A., Lee, T. H.
2008; 92 (1)
- **Monolithic integration of GaAs/AlGaAs phase modulator and photodetector for RF photonics** *Conference on Optical Fiber Communications/ National Fiber Optic Engineers Conference*
Jarrahi, M., Miller, D. A., Lee, T. H.
OPTICAL SOC AMERICA.2008: 106–108

- **High-Power Tunable Terahertz Generation based on Photoconductive Antenna Arrays** *2008 IEEE MTT-S International Microwave Symposium Digest*
Jarrahi, M., Lee, T. H.
IEEE.2008: 390–393
- **A System for Multiplexed Direct Electrical Detection of DNA Synthesis**, *Sensors & Actuators*
Anderson, E., P., Daniels, J., S., Yu, H., Karhanek, M., Lee, T., H., Davis, R., W.
2008; B 129: 79–86
- **The Future of Wireless Technology in the Fourth age – The Internet of Things**
Lee, T.
2008
- **Simultaneous Measurement of Nonlinearity and Electrochemical Impedance for Protein Sensing Using Two-Tone Excitation**
Daniels, J., S., Anderson, E., Lee, T., H., Pourmand, N.
2008
- **Optical switching based on highspeed phased-array optical beam steering** *Applied Physics Letters*
Jarrahi, M., Pease, R., F. W., Miller, D., A. B., Lee, T., H.
2008; 92
- **High-speed optical beam-steering based on phased arrayed waveguides**
Jarrahi, M., Pease, R., F. W., Miller, D., A. B., Lee, T., H.
2008
- **A Label-free CMOS DNA Microarray based on Charge Sensing**
Anderson, E., P., Daniels, J., S., Yu, H., Pourmand, N., Lee, T., H.
2008
- **RFIC Design & Implementation: An Introduction Plus** *IEEE short course, Singapore local Solid-State Circuits Society chapter, Singapore*
Lee, T.
2008
- **A Low-overhead Fault Tolerance Scheme for TSV-based 3D Network on Chip Links**
Loi, I., Mitra, S., Lee, T., H., Fujita, S., Benini, L.
2008
- **High-Power Tunable Terahertz Generation based on Photoconductive Antenna Arrays**
Jarrahi, M., Danielson, J., Lee, T., H.
2008
- **Simultaneous Measurement of Nonlinearity and Electrochemical Impedance for Protein Sensing Using Two-Tone Excitation** *30th Annual International Conference of the IEEE-Engineering-in-Medicine-and-Biology-Society*
Daniels, J. S., Anderson, E. P., Lee, T. H., Pounnand, N.
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- **High-Power Tunable Terahertz Generation based on Photoconductive Antenna Arrays** *2008 IEEE MTT-S International Microwave Symposium Digest*
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- **3-D nanoarchitectures with carbon nanotube mechanical switches for future on-chip network beyond CMOS architecture** *IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS I-REGULAR PAPERS*
Fujita, S., Nomura, K., Abe, K., Lee, T. H.
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- **Prospect of Ballistic CNFET in High Performance Applications: Modeling and Analysis** *ACM JOURNAL ON EMERGING TECHNOLOGIES IN COMPUTING SYSTEMS*
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- **"A general theory of phase noise in electrical oscillators" - Response** *IEEE JOURNAL OF SOLID-STATE CIRCUITS*
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- **Impact of a process variation on nanowire and nanotube device performance** *IEEE TRANSACTIONS ON ELECTRON DEVICES*
Paul, B. C., Fujita, S., Okajima, M., Lee, T. H., Wong, H. P., Nishi, Y.
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- **An analytical compact circuit model for nanowire FET** *IEEE TRANSACTIONS ON ELECTRON DEVICES*
Paul, B. C., Tu, R., Fujita, S., Okajima, M., Lee, T. H., Nishi, Y.
2007; 54 (7): 1637-1644
- **High-frequency noise in nanoscale metal oxide semiconductor field effect transistors** *JOURNAL OF APPLIED PHYSICS*
Navid, R., Jungemann, C., Lee, T. H., Dutton, R. W.
2007; 101 (12)
- **Optical Spatially Quantized High Performance Analog-to-digital Conversion** *Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science Conference*
Jarrahi, M., Miller, D. A., Pease, R. F., Lee, T. H.
IEEE.2007: 987-988
- **A circuit-based noise parameter extraction technique for MOSFETs**
Navid, R., Lee, T. H., Dutton, R. W., IEEE
IEEE.2007: 3347-+
- **A 10Gb/s Equalizer with Decision Feedback for High Speed Serial Links**
Kiaei, A., Matinpour, B., Bahai, A., Lee, T., H.
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- **The History of the Integrated Circuit: A Random Walk**
Lee, T.
2007
- **Engineering Perspectives on Alternative Energy**
Lee, T.
2007
- **From Oxymoron to Mainstream: The Evolution and Future of RF CMOS**
Lee, T., H.
2007
- **Optical Spatially Quantized High Performance Analog-to-digital Conversion**
Jarrahi, M., Miller, D., A. B., Fabian, R., Pease, W., Lee, T., H.
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- **RFID: Status, Promise and Challenges**
Lee, T.
2007
- **Oscillator Phase Noise** *Santa Clara Valley IEEE Solid State Circuits Society (SSCS) Chapter Program, RFIC Design Short Course, Santa Clara, CA*
Lee, T.
2007
- **Phase Noise in Oscillators**
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- **3D Nanoarchitectures with Carbon Nanotube Mechanical Switches for Future On-Chip Network Beyond CMOS Architecture** *IEEE TCA S-I Special Issue: Nanoarchitecture*

- Fujita, S., Nomura, K., Abe, K., Lee, T., H.
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- **Traveling wave spatial quantized analog-to-digital conversion** *IEEE/MTT-S International Microwave Symposium*
Jarrahi, M., Pease, R. F., Lee, T. H.
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 - **A 10Gb/s equalizer with decision feedback for high speed serial links** *IEEE Custom Integrated Circuits Conference*
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 - **From oxymoron to mainstream: The evolution and future of RF CMOS** *IEEE International Workshop on Radio-Frequency Integration Technology*
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IEEE.2007: 1–6
 - **High-voltage-tolerant I/O circuit design for USB 2.0-compliant applications** *IEEE Custom Integrated Circuits Conference*
Kim, M., Icking, H., Gossner, H., Lee, T. H.
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 - **Ordered and chaotic electrical solitons: Communication perspectives** *IEEE COMMUNICATIONS MAGAZINE*
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 - **A programmable 0.18- μ m CMOS electrochemical sensor microarray for biomolecular detection** *IEEE SENSORS JOURNAL*
Hassibi, A., Lee, T. H.
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 - **A 1.5- ν , 1.5-GHz CMOS low noise amplifier (vol 40, pg 1397, 2005)** *IEEE JOURNAL OF SOLID-STATE CIRCUITS*
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 - **Impact of geometry-dependent parasitic capacitances on the performance of CNFET circuits** *IEEE ELECTRON DEVICE LETTERS*
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 - **Device physics - Electrical solitons come of age** *NATURE*
Lee, T. H.
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 - **Modeling and analysis of circuit performance of ballistic CNFET** *43rd Design Automation Conference*
Paul, B. C., Fujita, S., Okajima, M., Lee, T.
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 - **A Programmable 0.18- μ m CMOS Electrochemical Sensor Microarray for Biomolecular Detection** *IEEE Sensors Journal*
Hassibi, A., Lee, T., H.
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 - **Candidate THz Sources: The History and Future of Velocity-Modulated Devices** *Photonics West, San Jose, CA*
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 - **RF ID: Promise and Challenges**
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- **Novel architecture based on floating gate CNT-NEMS switches and its application to 3D on-chip bus beyond CMOS architecture**
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- **3D on-chip networking technology based on post-Silicon devices for Future Network on Chip**
Fujita, S., Nomura, K., Abe, K., Lee, T., H.
2006
- **Coupled Inverter Ring I/Q Oscillator for Low Power Frequency Synthesis**
Xu, J., Verma, S., Lee, T., H.
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- **Ordered and Chaotic Electrical Solitons: Communication Perspectives, *IEEE Communications Magazine***
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- **Device Physics: Electrical Solitons Come of Age *Nature***
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- **Things about stuff *MESA Community Colleges Statewide Day, Noe Lozano***
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- **Candidate THz sources: the history and future (?) of velocity-modulated devices *Conference on Terahertz and Gigahertz Electronics and Photonics V***
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- **3D on-chip networking technology based on post-silicon devices for future networks-on-chip. *1st International Conference on Nano-Networks and Workshops***
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Fujita, S., Nomura, K., Abe, K., Lee, T. H.
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- **Monolithic integrated millimeter-wave IMPATT transmitter in standard CMOS technology *IEEE MTT-S International Microwave Symposium***
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- **Comprehensive study of noise processes in electrode electrolyte interfaces (vol 96, pg 1074, 2004) *JOURNAL OF APPLIED PHYSICS***
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- **Bioluminescence regenerative cycle (BRC) system: Theoretical considerations for nucleic acid quantification assays *BIOPHYSICAL CHEMISTRY***
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- **A 1.5-V, 1.5-GHz CMOS low noise amplifier (vol 32, pg 745, 1997) *IEEE JOURNAL OF SOLID-STATE CIRCUITS***
Shaeffer, D. K., Lee, T. H.
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- **Biological shot-noise and quantum-limited signal-to-noise ratio in affinity-based biosensors** *JOURNAL OF APPLIED PHYSICS*
Hassibi, A., Zahedi, S., Navid, R., DUTTON, R. W., Lee, T. H.
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- **An analytical formulation of phase noise of signals with Gaussian-distributed jitter** *IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS II- EXPRESS BRIEFS*
Navid, R., Lee, T. H., DUTTON, R. W.
2005; 52 (3): 149-153
- **Minimum achievable phase noise of RC oscillators** *IEEE JOURNAL OF SOLID-STATE CIRCUITS*
Navid, R., Lee, T. H., DUTTON, R. W.
2005; 40 (3): 630-637
- **A high dynamic range programmable CMOS front-end filter with a tuning range from 1850 to 2400 MHz** *21st NORCHIP Conference*
Christensen, K. T., Lee, T. H., Bruun, E.
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- **A Programmable Electrochemical Biosensor Array in 0.18 μ m Standard CMOS**
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- **Biological Shot-noise and Quantum-Limited SNR in Affinity-Based Biosensor** *Journal of Applied Physics*
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- **A 17.1mW, 0.66mm², Direct Conversion Receiver for 1Mb/s Cable Replacement**
Verma, S., Xu, J., Hamada, M., Lee, T., H.
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- **A 77GHz Monolithic IMPATT Transmitter in Standard CMOS Technology**
Al-Attar, T., Hassibi, A., Lee, T., H.
2005
- **A Constant-Frequency Method for Improving Light-Load Efficiency in Synchronous Buck Converters** *IEEE Power Electronics Letters*
Mulligan, M., D., Broach, B., Lee, T., H.
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 - **Lateral IMPATT Diodes in Standard CMOS Technology** *International Electron Devices Meeting Technical Digest, San Francisco, CA*
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 - **A Comprehensive Study of Noise Processes in Electrode-electrolyte Interfaces** *Journal of Applied Physics*
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