İlke ERCAN

Department of Microelectronics
TU Delft Building 36,
Mekelweg 4, 2628 CD, Delft
The Netherlands

Tel: + 31 15 27 84236
i.ercan@tudelft.nl
ORCID ID: 0000-0003-1339-9703
microelectronics.tudelft.nl/∼ilke

Research Interests: Emerging and unconventional computing paradigms; Fundamental energy efficiency limitations in computing; Nanoelectronics; Nanophotonics; Quantum-computing; Physical-information theory; Thermodynamics of computation.

Teaching Interests: Introduction to Electrical Engineering, Physics of Semiconductor Devices, Circuit Theory, Electronics, Physical-Information Theory, Probability and Random Processes, Thermodynamics.

Education

University of Massachusetts, Amherst MA, USA

Ph.D., Electrical & Computer Engineering (ECE) **Fall 2008 - Spring 2014**

Advisor: Professor Neal G. Anderson
Area of Study: Heat Dissipation Bounds for Nanocomputing: Methodology and Applications

M.S., Electrical & Computer Engineering (ECE) **Fall 2006 - Summer 2008**

Advisor: Professor Neal G. Anderson
Area of Study: Electron Transport Properties and Information Bounds of Nanoscale Conductors by Microcanonical Approach

Middle East Technical University, Ankara, Turkey

B.S., Physics, Solid State Physics **Fall 2002 - Summer 2006**
Minor, Logic and Philosophy of Science **Spring 2004 - Summer 2006**

Academic Positions

TU Delft Department of Microelectronics
Associate Professor **Spring 2023 - present**
Principal Educator **Spring 2021 - Spring 2023**

University College Roosevelt Engineering Department
Associate Professor **Fall 2019 - Spring 2021**

Boğaziçi University Department of Electrical and Electronics Engineering
Assistant Professor **Fall 2015 - Spring 2020**

Massachusetts Institute of Technology Electronic Materials Research Group (EMAT)
Visiting Reserecher **Summer 2018**

Sabancı University Foundations Development Program
Part-Time Instructor **Spring 2018**

TU Darmstadt Institute for Semiconductor Technology and Nanoelectronics and Institute for Philosophy
Postdoctoral Research Fellow **Spring and Summer 2015**

Smith College Picker Engineering Program
Visiting Faculty **Spring and Fall 2014**

Research and Teaching Grants

TU Delft Education Fellowship (PI) **2023 - 2024**
MIT International Science and Technology Initiatives Seed Fund (co-PI) **2018 - 2020**
TÜBİTAK 3501 Career Development Grant (PI) **2017 - 2019**
Boğaziçi University Start-up Research Grant (PI) **2016 - 2019**
TÜBİTAK 2219 Postdoctoral Research Grant (PI) **2014 - 2015**

Research Awards

IEEE 12^{th} International Conference on Nanotechnology First Place Best Oral Conference Paper **2012**
IEEE 11^{th} International Conference on Nanotechnology Best Paper Award **2011**

Teaching Awards

TU Delft Department of Microelectronics Teacher of the Year **2022**
Boğaziçi University Faculty of Engineering Excellence in Teaching Award **2018**
UMass Amherst ECE Outstanding Teaching Assistant Award **2012**

Teaching Certificates

TU Delft University Teaching Qualification (UTQ) Exemption **2021**
Utrecht University Basic University Teaching Qualification (BTQ) **2020**

Publications

Preprint

1. S. Faletic, P. Bitzenbauer, M. Bondani, M. Chiofalo, S. Goorney, K. Krijtenburg-Lewerissa, O. Mishina, R. Muller, G. Pospiech, **İ. Ercan**, M. Malgieri, A. Merzel, M. Michelini, P. Onorato, H. Pol, L. Santi, Z. C. Seskir, J. Sherson, K. Stadermann, A. Stefanel, E. Surer, K. Toth, J. Y. Malo, O. Zabello, "Contributions from Pilot Projects in Quantum Technology Education as Support Action to Quantum Flagship," March 13, 2023. arxiv: 2303.07055

Selected Peer-Reviewed Journal Articles

1. Z. C. Seskir, P. Migdal, C. A. Weidner, A. Anupam, N. Case, N. Davis, C. Decaroli, **İ. Ercan**, C. Foti, P. Gora, K. Jankiewicz, B. R. La Cour, J. Y. Malo, A. Naeemi, L. Nita, N. Parvin, F. Scafirimuto, J. Friis Sherson, E. Surer, J. R. Wootton, L. Yeh, O. Zabello and M. Chiofalo."Quantum Games and Interactive Tools for Quantum Technologies Outreach and Education: A Review and Experiences from the Field," *Optical Engineering*, 61(8), 081809, 2022. doi.org/10.1117/1.OE.61.8.081809

2. **İ. Ercan**, Z. D. Sütgöl, and F. O. Özhan, "Physical Limitations on Fundamental Efficiency of SET-Based Brownian Circuits," *Entropy*, vol. 23 no 4, 406, 2021. doi.org/10.3390/e23040406

3. S. Barışık and **İ. Ercan**, "Thermodynamic Cost of Edge Detection in Artificial Neural Network (ANN)-Based Processors," *International Journal of Parallel, Emergent and Distributed Systems*, Published online: 29 Oct 2020. doi: 10.1080/17445760.2020.1836639

4. F. Dinç, **İ. Ercan** and A. M. Brańczyk, "Exact Markovian and non-Markovian time dynamics in waveguide QED: collective interactions bound states in continuum, superradiance and subradiance," *Quantum*, vol. 3, p. 213, 9 December, 2019. doi: 10.22331/q-2019-12-09-213

5. **İ. Ercan** and E. Suyabatmaz "Fundamental Energy Limits of SET-Based Brownian NAND and Half-Adder Circuits," *European Physical Journal B*, vol. 91 p. 113, 2018. doi: 10.1140/epjb/e2018-80619-6

6. F. Dinç and **İ. Ercan** "Single Photon Two-Level Atom Interactions in 1-D Dielectric Waveguide: Quantum Mechanical Formalism and Applications" *Optical and Quantum Electronics (OQEL)*, 50: 390, Published Online October 15, 2018. doi: 10.1007/s11082-018-1658-y

7. F. Dinç and **İ. Ercan** "Quantum Mechanical Treatment of Two-Level Atoms Coupled to Continuum with an Ultraviolet Cutoff," *Journal of Physics A: Mathematical and Theoretical,* vol. 51, no 35, p. 355, 2018. doi: 10.1088/1751-8121/aad165

8. **İ. Ercan** and N. Anderson, "Heat Dissipation in Nanocomputing: Lower Bounds from Physical Information Theory," *IEEE Transactions on Nanotechnology,* vol. 12, no. 6, pp. 1047 - 1060, 2013. doi: 10.1109/tnano.2013.2276938

9. N. Anderson, **İ. Ercan** and N. Ganesh, "Toward Nanoprocessor Thermodynamics," *IEEE Transactions on Nanotechnology,* vol. 12, no. 6, pp. 902 - 909, 2013. doi: 10.1109/tnano.2013.2260352

10. **İ. Ercan** and N. Anderson, "Tight-biding Implementation of the Microcanonical Approach to Transport in Nanoscale Conductors: Generalization and Analysis," *Journal of Applied Physics*, vol. 107 no. 12, pp. 124318-13, 2010. doi: 10.1063/1.3388055

11. **İ. Ercan** and N. Anderson, "Current and Information in the Microcanonical Picture of Nanoscale Transport," *Journal of Computational Electronics,* vol. 7, no 3., pp. 466 - 470, 2008. doi: 10.1007/s10825-008-0234-2

12. **İ. Ercan** and S. Katırcıoğlu, "The Electronic Structure of Capped and Uncapped CdS Nanoparticles," *Journal of Nanoscience and Nanotechnology* 8, pp. 645 - 649, 2008. doi: 10.1166/jnn.2008.A219

Book Chapters

1. A. Vartanyan, T. Arman, **İ. Ercan**, and A. D. Pinçe, "Boğaziçi Üniversitesi'nde Cinsel Tacizi Önleme Çalışmaları Sürecinde Şemsa Özar'la Yol Arkadaşlığımız (Working with Şemsa Özar in Sexual Harassment Prevention Committee at Bogazici University)," *Feminizm, Ekoloji, Toplumsal Direniş (Feminism, Ecology, Collective Resistance), Eds. H. Çağlayan and K. A. Türker*, İstanbul, 2022. ISBN: 978-605-260-367-3.

2. **İ. Ercan** and N. Anderson, "Modular Dissipation Analysis for QCA," *Field-Coupled Nanocomputing, N.G. Anderson and S. Bhanja. Eds. Lecture Notes in Computer Science,* vol. 8280, pp. 357-375, Heidelberg, 2014. doi: 10.1007/978-3-662-43722-3_15

Conference Proceedings

1. S. van Rijs, **İ. Ercan**, A. Vladimirescu, and F. Sebastiano, "Single-Electron-Transistor Compact Model for Spin-Qubit Readout," *Proceedings of SMACD'23: International Conference on Synthesis, Modeling, Analysis and Simulation Methods and Applications to Circuit Design*, 3-5 July 2023.

2. M. Chiofalo, A. Anupam, M. Bondani, **İ. Ercan**, S. Goorney, M. Michelini, L. Santi, Z. Seskir, J. F. Sherson, A. Stefanel J. Y. Malo, E. Surer, C. A. Weidner, and O. Zabello, "Cultural Storytellings in Quantum Science and Technology Education," *GIREP Conference 2022: Effective Learning in Physics from Contemporary Physics to Remote Settings*, July, 2022.

3. O. Yakar, Y. Nie, K Wada, A. Agarwal and **İ. Ercan**, "Energy Efficiency Analyses of Microring-Resonator-Based BDD Logic Circuits," *Proceedings of the IEEE International Conference on Rebooting Computing*, 28 November, 2019. doi: 10.1109/ICRC.2019.8914708

4. **İ. Ercan**, Ö. Susam, M. Altun, and M. H. Cılasun, "Synthesis and Fundamental Energy Analysis of Fault-Tolerant CMOS Circuits," *IEEExplore Proceedings of SMACD'17: International Conference on Synthesis, Modeling, Analysis and Simulation Methods and Applications to Circuit Design,* 12-15 June 2017. doi: 10.1109/smacd.2017.7981586

5. **İ. Ercan**, "Fundamental Energy Dissipation Limits in Logic Circuits," *ICT Energy Letters,* vol. 12, pp. 3-4, August 2016. (**Invited Paper**)

6. N. Anderson, **İ. Ercan** and N. Ganesh, "Toward Nanoprocessor Thermodynamics," *Proceedings of the* 12^{th} *IEEE Conference on Nanotechnology (IEEE NANO, 2012),* 2012. doi: 10.1109/nano.2012.6322186 (**First Place Best Oral Conference Paper**)

7. **İ. Ercan** and N. Anderson, "Heat Dissipation in Nanocomputing: Theory and QCA Application," *Proceedings of the* 11^{th} *IEEE Conference on Nanotechnology (IEEE NANO, 2011)*, pp.1289-1294, 2011. doi: 10.1109/nano.2011.6144346 (**Best Paper Award**)

8. **İ. Ercan**, M. Rahman and N. Anderson, "Determining Fundamental Heat Dissipation Bounds for Transistor-Based Nanocomputing Paradigms," NANOARCH'11: IEEE/ACM Symposium on Nanoscale Architectures, *Proceedings of the 2011 IEEE/ACM International Symposium on Nanoscale Architectures*, pp. 169 - 174, 2011. doi: 10.1109/nanoarch.2011.5941500

9. **İ. Ercan** and N. Anderson, "Structure Dependence of Nanoconductor Current in a Tight-Binding Microcanonical Model," *NANO'08: Proc. of the* 8^{th} *IEEE Conference on Nanotechnology (IEEE NANO, 2008)*, pp. 331 - 334. doi: 10.1109/nano.2008.104

10. **İ. Ercan** and N. Anderson, "Structure Dependence of Nanoconductor Current in a Microcanonical Transport Model," *Proceedings of the* 17^{th} *Annual Connecticut Symposium on Microelectronics and Optoelectronics*, pp. 39 - 40, April, 2008.

Oral Presentations

1. **İ. Ercan** and B. Kılınç, "Entropy, Information, and Their Relation to Energy: Implications in Science and Engineering" *Philosophy of Science Around the Mediterranean POND 3: Unity/ Disunity of Science*, Lisbon, Portugal, September 21, 2018.
2. **İ. Ercan**, "Energetic Cost of Information Processing at the Quantum Precipice: A Physical-Information-Theoretic Approach," *KOBIT-2, Quantum Optics and Information Meeting*, İstanbul, Turkey, 1-2 February, 2018. (**Invited Talk)**
3. **İ. Ercan**, "Energy Efficiency Limit in Brownian Circuits," *Micro Energy*, Gubbio, Italy, 3- 7 July, 2017. (**Invited Talk)**
4. **İ. Ercan**, Ö. Susam, M. Altun, and M. H. Cılasun, "Synthesis and Fundamental Energy Analysis of Fault-Tolerant CMOS Circuits," *SMACD'17: International Conference on Synthesis, Modeling, Analysis and Simulation Methods and Applications to Circuit Design,* Giardini Naxos, Italy, 12-15 June 2017.
5. **İ. Ercan**, "Fundamental Energy Dissipation Limits in Logic Circuits," *ICT Energy Science Conference*, Aalborg, Denmark, 16- 19 August, 2016. (**Invited Talk)**
6. **İ. Ercan**, "Making of Measurement on Limits: Examples from Nanoelectronics," *The Making of Measurement Conference,* University of Cambridge, July 24, 2015.
7. **İ. Ercan**, N. Ganesh, and N. Anderson, "Modular Dissipation Analysis for QCA," *FCN 13: The Workshop on Field Coupled Nanocomputing,* Tampa, FL, February 7, 2013.
8. **İ. Ercan**, "A Case Study of Actor-Network Theory: The Structure of Scientific Research on Nanoscale Semiconductor Devices," *ST Global Consortium Science and Technology in Society Conference*, Washington, DC, March 31, 2012.
9. **İ. Ercan** and N. Anderson, "Heat Dissipation in Nanocomputing: Theory and QCA Application," *IEEE NANO'11:* 11^{th} *IEEE Conference on Nanotechnology*, Portland OR, August 18, 2011. (**Best Paper Award**)
10. **İ. Ercan**, M. Rahman and N. Anderson, "Determining Fundamental Heat Dissipation Bounds for Transistor-Based Nanocomputing Paradigms," *NANOARCH '11: IEEE/ACM Symposium on Nanoscale Architectures*, San Diego, CA, June 2011.
11. **İ. Ercan** and N. Anderson, "Structure Dependence of Nanoconductor Current in a Tight-Binding Microcanonical Model," *IEEE* 8^{th} *International Conference on Nanotechnology*, Arlington, TX, August 19, 2008.
12. **İ. Ercan** and N. Anderson, "Structure Dependence of Nanoconductor Current in a Microcanonical Transport Model," 17^{th} *Annual Connecticut Symposium on Microelectronics and Optoelectronics*, Storrs, CT, April 9, 2008.

Selected Invited Public Lectures

1. **İ. Ercan**, "Belonging through Agency: Student Involvement and Community Building in University Education," *TU Delft Education Day*, November 10, 2022.
2. **İ. Ercan**, "Fiziksel Enformasyon Teorisi: Kavramlar ve Yanlış Anlamalar (Physical Information Theory: Concepts and Misunderstanding)," 5^{th} *Systems and Control Engineering Graduate Student Camp*, The Chamber of Electrical Engineers (EMO), Nesin Math Village Şirince, Spring 2017.
3. **İ. Ercan**, "Integrative Approach to Education in Turkey," *Boğaziçi University IEEE Student Branch Science, Technology, Engineering, Arts, and Math (STEAM) Workshop,* October 1, 2016.
4. **İ. Ercan**, "Teknolojilerin Sınırlarınıve Gelişmelerini Etkileyen Faktörler (Factors Affecting the Limits and Evolution of Technologies," *Sabancı University, Science Canteen*, May 21, 2014.

Courses Taught

TU Delft

EE1C11: Linear Circuits A (responsible co-instructor), EE1C21: Linear Circuits B (responsible co-instructor), EE1P11: Classical and Quantum Mechanics (co-instructor), EE1P21: Electricity and Magnetism (co-instructor), EE1L11: EPO-1 and EE1L21: EPO-2 (tutor)

University College Roosevelt
SCIMATH 101: Calculus for Scientists, ENGPROJ102: Sensing Systems for Sustainability, ENGELEC101: Basic Electronics and Circuits

Sabancı University
NS 102: Science of Nature (Brain Module)

Boğaziçi University
EE 101: Orientation to Electrical Engineering, EE 202: Electrical Circuits II, EE 313: Probability for Electrical Engineers, EE 335: Electronics Laboratory, EE 58M: Intro to the Physical-Information-Theory

Smith College
EGR 220: Circuit Theory, EGR 390: Advanced Topics in Engineering: Semiconductor Technologies

University of Massachusetts, Amherst
Engin 112: Introduction to Electrical and Computer Engineering, ECE 211: Circuit Analysis I, ECE 212: Circuit Analysis II, ECE 314: Introduction to Probability and Random Processes, ECE 344: Semiconductor Devices and Materials, EE 572: Optoelectronics, PHYS 132: Introductory Physics Laboratory

Professional Service Contribution

Technical Programme Committee Member: Design, Automation and Test in Europe Conference (DATE'23) Applications of Emerging Technologies track

Ad-Hoc Reviewer: Scientific Reports, Journal of Applied Physics, IEEE Transactions on Nanotechnology, IEEE Transactions on Very Large Scale Integration Systems

Co-Editor and Ad-Hoc Reviewer: Springer Lecture Notes on Computer Science State-of- the-Art-Survey Series Special Volume on Field-Coupled Nanocomputing

Outreach Activities

TU Delft, EEMCS
Women+ in Engineering Affinity Group, Faculty Co-Advisor **Fall 2021 - present**

University College Roosevelt
Eleanor Green Office, Faculty Advisor **Fall 2019 - Spring 2021**

Sabancı University
Gender Studies Center (SUGender), STEM Education Academic Consultant **Summer 2017 - Fall 2018**

Boğaziçi University
IEEE Women in Engrineering Affinity Group, Faculty Advisor **Fall 2015 - 2019**
Sexual Harassment Prevention Committee, Member **Fall 2015 - 2019**

Smith College
Wearable Electronics Workshop, Facilitator **Fall 2012**
Museum of Art Family Day, Science Education Consultant **Fall 2006**

University of Massachusetts Amherst, Science, Technology and Society Initiative
Internatinal Dimensions of Ethics Education in Science and Engineering, Focus Group Member **Fall 2008**

Professional Affiliations

Institute of Electrical and Electronics Engineers (IEEE) **2006 - present**
The Society of Women Engineers (SWE) **2011 - 2014**
International Association of Computing And Philosophy (IACAP) **2010 - 2014**
American Association of University Women (AAUW) **2011 - 2014**

Languages

Turkish (native), English (fluent written and spoken, ITAV: C2), Dutch (advanced beginner).

Updated: May 12, 2023