Dr. Hamdy Abdelhamid

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- **Location:** Ajman University, Ajman, United Arab Emirates
- **Original:** Egypt

Websites & Social Links

ResearchGate

Hamdy Abdelhamid (0000-0003-3429-8127) - My ORCID

Hamdy Abdelhamid - Google Scholar

Abdelhamid, Hamdy - Author details - Scopus Preview

Keywords
Professor, CAD Tools, Microelectronics, Semiconductor Devices, VLSI, Biosensors, Energy Harvesting

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Biography

Dr. Hamdy Abdelhamid holds a Diplôme des Études Approfondies (DEA) obtained in 2005 and a Ph.D. with a European Doctorate awarded in 2007 from Universitat Rovira i Virgili, Spain. His doctoral research focused on developing CAD models for modern (nanoscale) SOI MOSFETs, analyzing their performance from DC to RF conditions.

In 2005, Dr. Abdelhamid served as a Graduate Visiting Researcher at the University of Liverpool's Electrical Engineering Department, UK. He joined the Microelectronics Laboratory at Université catholique de Louvain, Belgium, in 2007 and participated in various short courses on Silicon On Insulator (SOI) technology at academic and industrial institutions.

From October 2007 to September 2009, he worked as a Postdoctoral Fellow at McMaster University's Department of Electronics Engineering, Canada. Subsequently, from September 2012 to 2019, he contributed to the Center of Nanoelectronics and Devices at Zewail City of Science and Technology, Egypt.

Dr. Abdelhamid has authored and co-authored over 90 research papers on device modeling, energy harvesting, biosensors, VLSI, and device/circuit simulations, published in international

journals and conference proceedings. He has also contributed to several book chapters, patents, and prototypes.

He has received funding from ITIDA (Egypt) for projects on energy harvesting and biomedical platforms, as well as from ASRT for designing and fabricating CMOS micro-energy harvesting sources. At Ajman University, he secured funding for implementing micro-grid systems and developing a biosensor platform for bacteria detection and COVID-19.

An IEEE Senior Member since 2015, Dr. Abdelhamid is also a member of the American Nano Society and the Nanotech-Bank, reflecting his contributions to nanoelectronics and nanotechnology. In 2020, he was nominated as a Technical Committee Member of the IEEE Electron Devices Society (EDS). Currently, he serves as a full-time professor in the Electrical Engineering Department at Ajman University, UAE, since January 2019.

Employment History

- **Ajman University of Science and Technology, College of Engineering**
  Associate Professor (Full-time) - towards Professor rank
  January 2019 – Present
  Ajman, AE
- **Zewail City of Science and Technology**
  Associate Professor, Nanoelectronics and Devices (Full-time)
  October 2012 – January 2019
  Cairo, EG
- **American University in Cairo**
  Associate Professor, Nanoelectronics and Devices (Adjunct)
  October 2012 – January 2019
  Cairo, EG
- **British University in Egypt**
  Assistant Professor, Electronics Engineering Dept. (Full-time)
  October 2009 – September 2010
  Cairo, EG
- **McMaster University, Faculty of Engineering**
  Postdoctoral Fellowship, Microelectronics Engineering Dept. (Full-time)
  October 2007 – September 2009
  Hamilton, ON, CA
- **Université catholique de Louvain**
  Senior Researcher (Full-time)
  March 2007 – June 2007
  Louvain-la-Neuve, BE
- **University of Liverpool, Department of Electrical Engineering and Electronics**
  Full-Time Researcher (Department of Electrical Engineering and Electronics)
  May 2005 – September 2005
  Liverpool, GB

Education

- **Universitat Rovira i Virgili**
  Ph.D. in Electronics Engineering
  October 2003 – June 2007
  Tarragona, Catalunya, ES
- **Universitat Rovira i Virgili**
  Diplôme des Études Approfondies (DEA) in Electronics Engineering
  October 2003 – October 2005
  Tarragona, Catalunya, ES
- **Ain-Shams University**
  Master of Electronics and Communications Engineering
  January 2000
  Cairo, EG

Awards:

Europe Doctorate in Electrical Engineering, 2007

Memberships

- IEEE Solid-State Circuits Society (2021)
- IEEE Electron Devices Society (2019 – Present)
- **Technical Committee Member, -** IEEE Electron Devices Society (2019 – 2022)
- Technical Committee Member, Deepen Local Manufacturing - Electronics Industry (DLMEI) (2017 – Present)
- IEEE Senior Member (2015 – Present)
- Member, American Nano Society (2012 – Present)

Funded Projects

1. **(PI) Characterization of efficient Nanostructured Perovskite Solar Cells**
   a. Ajman University, AE
      Grant: October 2023 – September 2024
2. (PI) Well-organized Nanostructures Photovoltaics for Solar Light Harvesting Application,
   a. Ajman University, AE
      Grant: October 2021 – September 2022
3. **(PI) Neuromorphic Flexible Electronics for Biosensor Applications (NeuFEBA)**
   Ajman University, AE
   Grant: October 2021 – September 2022
4. **(CO-PI) Micro-grid Inverter Design and Implementation**
   Ajman University, AE
   Grant: October 2020 – September 2021

5. **(PI) Rapid Testing Platform for COVID-19**
   Ajman University, AE
   Grant: May 2020 – April 2021
6. **(PI) Platform for Food Bacteria Detection**
   Ajman University, AE
   Grant: September 2019 – October 2020
7. **(PI) CMOS Thermoelectric Generator Design and Implementation**
   Academy of Scientific Research and Technology (ASRT), EG
   Grant: May 2017 – January 2019
8. **(CO-PI) CMOS Platform for Hepatitis-C Detection**
   Academy of Scientific Research and Technology, EG
   Grant: February 2015 – February 2017
9. **(CO-PI) PV's Characterizer of Cheap Design**
   Information Technology Industry Development Agency (ITIDA), EG
   Grant: 2017 – 2018
10. **Center of excellence on Wearable electronics, PI,** Academy of Scientific Research and Technology (ASRT), EG
    Grant: May 2015 – January 2018

Research Focus

My research focuses on the development and application of **compact models and advanced 2D/3D simulations** to explore the electrical and electronic properties of various systems, specifically in the areas of semiconductor devices, biosensors, and renewable energy sources. These domains represent critical components of modern technology and hold the potential for significant advancements in electronics, healthcare, and sustainable energy.

In the realm of **semiconductor devices,** my work aims to create accurate compact models that encapsulate the intricate behaviours of these systems. By rigorously validating these models against **experimental and simulation results,** I ensure their reliability and applicability in circuit simulations. This verification process not only enhances our understanding of semiconductor behaviour at the nano/micro scale but also facilitates the integration of these devices into comprehensive circuit simulation software, such as Cadence. By implementing Verilog-Analog within these frameworks, I strive to enable the detailed analysis of integrated systems, providing insights into their performance under various conditions.

In addition to semiconductor applications, I have directed my efforts towards the development of **biosensors,** which play an increasingly pivotal role in healthcare and environmental monitoring. Through the introduction of tailored compact models for biosensors, my research addresses the unique challenges posed by biological interactions and the need for sensitivity and specificity in detection. By integrating these models into circuit simulation tools, I can assess the performance of biosensor systems in real-world applications, ultimately contributing to the advancement of biotechnological solutions.

Renewable energy sources represent another vital area of my research. As global energy demands grow, the efficient integration of renewable technologies becomes essential. My work focuses on creating compact models that accurately represent the electrical characteristics of

renewable energy systems, such as solar cells and thermal energy devices. By coupling these models with simulation tools, I facilitate the design and optimization of integrated energy systems that can adapt to fluctuating energy inputs and demand, paving the way for more sustainable energy solutions.

The contributions I have made in these diverse areas of research have been recognized through my selection as a **Compact Modelling Technical Committee Member** of the IEEE Electron Devices Society. This role reflects my commitment to advancing the field and underscores the impact of my work in developing novel models that enhance the understanding of electrical properties across multiple applications.

In conclusion, my research not only pushes the boundaries of knowledge in semiconductor technology, biosensing, and renewable energy but also fosters practical solutions that can be seamlessly integrated into existing systems. Through continued collaboration and innovation, I aim to contribute significantly to the fields of nano/microelectronics, biotechnology, and sustainable energy, ultimately driving forward the development of advanced technologies that address contemporary challenges.

I would like to highlight that Ajman University has signed **a Memorandum of Understanding (MOU) with Zewail University** to facilitate research collaboration and a student exchange program. In this context, I am actively collaborating with their research groups across various areas. Zewail University boasts state-of-the-art biological laboratories and a Class 1000 clean room, which can be utilized for nanoelectronics fabrication.

Selected Publications
(For brevity, only a few publications are listed. You can find the complete list of publications in the appendix.)

1. Thermal, mechanical, and electrical properties of Si-stacked nanosheet transistors using machine learning interatomic potentials, NANOTECHNOLOGY, ACCEPTED, SEPTEMBER, 2024
2. Optical and Electrical Characteristics of Dome Tapered Silicon Nanowires for Efficient Photovoltaic Solar Energy Conversion, OPTICAL AND QUANTUM ELECTRONICS, ACCEPTED, OCTOBER 2024.
3. Polarization dependent exciton-plasmon coupling in PEA2PbI4/Al and its application to perovskite solar cell, Optics Express, 2024
4. Impact of aluminium concentration and grading configuration of AlxGa1-xAs nanostructures for solar absorber applications, Journal of Photonics for Energy, 2024
5. A Comprehensive Survey of Silicon Thin-film Solar Cell: Challenges and Novel Trends, Plasmonics Journal, 2024
6. The Effects of Temperature Variation with Surface Triangle Grating on Silicon Thin-Film Solar Cell Array Efficiency, Plasmonics Journal, 2023
7. Impact of bottom dielectric isolation of Si-stacked nanosheet transistor on stress and self-heating at 3-Nm node and beyond, IEEE Transaction On Electrond Devices, 2023
8. A capacitive sensor for differentiation between virus-infected and uninfected cells,
9. Journal of Sensing and Bio-Sensing Research, 2022,
10. Experimental Validation of Different PV Technologies Using a Physical-based Model, Optical and Quantum Electronics, 2022

Thesis Supervision

Doctoral Degrees:

1. Eman Sawiraess, *"0.13µm CMOS Thermoelectric Generators: Design, Fabrication, and Simulations,"* Helwan University, 2018.
2. Mohamed Eldakrury, *"Power Device Modeling, Simulations, and Characterization,"* Helwan University, 2019.
3. Azza Anis, *"Spin Effects on Nanoscale Devices and Systems,"* Helwan University, 2019.
4. Khalil Khamis, *"Nanoscale Thin Film Solar Cell Optimizations and Efficiency Enhancement,"* Menufia University, 2022.
5. Mohamed Saleh, *"Nanosheets Devices and Performance for 3 nm and Beyond,"* 2024, ongoing.

Master's Degrees: 6. Ahmed Elthakeb, *"Technology Road Map of Nanoscale Devices and Systems for 14 nm and Beyond,"* American University in Cairo, 2016. 7. Rana Khashen, *"Quantum Devices and Short Channel Effects,"* American University in Cairo, 2019. 8. Omnaya Samy, *"Reliability and Device Aging for Nanoscale Defects,"* Ain Shams University, 2018. 9. Sameh Sherif, *"Biomedical Platform for Cancer Detection,"* Helwan University, 2018. 10. Ahmed Husaien, *"Nanoscale Floating Gate Devices for Flash Memory Modeling and Simulations,"* Cairo University, 2018. 11. Ibrahim Khalaf, *"CMOS Platform for Cell Separation Modeling and Simulation,"* Cairo University, 2022.

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Appendix (list of publications)

1. Thermal, mechanical, and electrical properties of Si-stacked nanosheet transistors using machine learning interatomic potentials, NANOTECHNOLOGY, 36 (1), 2025.

2. Assessment of Leakage Current Reduction Techniques for Si-Stacked Nanosheet Transistor at 3-nm Node and Beyond, Novel Intelligent and Leading Emerging Sciences Conference (NILES), 2024. DOI: 10.1109/NILES63360.2024.10753173.

3. Optical and Electrical Characteristics of Dome Tapered Silicon Nanowires for Efficient Photovoltaic Solar Energy Conversion, OPTICAL AND QUANTUM ELECTRONICS, Volume 57, article number 83, (2025).
4. hang, Q., Zhao, M., Li, Y., Bian, A., El-Bashar, R., Abdelhamid, H., Obayya, S., Hameed, M., & Dai, J. (2024). Polarization dependent exciton-plasmon coupling in PEA2PbI4/Al and its application to perovskite solar cell. Optics Express, 32(14), 25327.

5. Khaled, A., Hameed, M., Abdelhamid, H., & Obayya, S. (2024). Impact of aluminum concentration and grading configuration of AlxGa1-xAs nanostructures for solar absorber applications. Journal of Photonics for Energy, 14(02).

6. El-Bashar, R., Hameed, M., Abdelhamid, H., Dai, J., & Obayya, S. (2023). Numerical Investigation of Si Nanowires Integrated Perovskite for Efficient Tandem Solar Cell. In 2023 24th International Arab Conference on Information Technology (ACIT) (pp. 1–4). IEEE.

7. Khalil ElKhamisy, Hamdy Abdelhamid, El-Sayed El-Rabaie, & Nariman Abdel-Salam (2023). The Effects of Temperature Variation with Surface Triangle Grating on Silicon Thin-Film Solar Cell Array Efficiency. Plasmonics.

8. Khalil ElKhamisy, Hamdy Abdelhamid, El-Sayed M. El-Rabaie, & Nariman Abdel-Salam (2023). A Comprehensive Survey of Silicon Thin-film Solar Cell: Challenges and Novel Trends. Plasmonics.

9. Amgad A. El-Deib, Hamdy Abdelhamid, Khaled El-Shekh, Khalil ElKhamisy, & Zulfiqar Memon (2023). Control of Hydrogen based Virtual Power Plant in Hybrid AC/DC Microgrids. In 2023 IEEE Conference on Power Electronics and Renewable Energy (CPERE). IEEE.

10. Saleh, M., Bayoumi, A., & Abdelhamid, H. (2023). Impact of Bottom Dielectric Isolation of Si-Stacked Nanosheet Transistor on Stress and Self-Heating at 3-nm Node and Beyond. IEEE Transactions on Electron Devices, 70(11), 5535–5542.

11. A capacitive sensor for differentiation between virus-infected and uninfected cells, Journal of Sensing and Bio-Sensing Research, 2022 Article, DOI: doi.org/10.1016/j.sbsr.2022.100497

12. **Experimental Validation of Different PV Technologies Using a Physical-based Model,** *Optical and Quantum Electronics,* 2022 | journal-article, DOI: 10.1007/s11082-022-03768-8

13. **The efficiency of silicon thin film solar cell: impact of temperature with different surface sha pes,** *Optical and Quantum Electronics,* 2022 | journal-article, DOI: 10.1007/s11082-021-03433-6

14. **Dielectrophoretic based Microfluidic for nanoparticles "viruses" separation,** 2021 3rd Novel I ntelligent and Leading Emerging Sciences Conference (NILES), DOI: 10.1109/NILES53778.202 1.9600490 | Conference-Proc.

15. **The effect of different surface plasmon polariton shapes on thin-film solar cell efficiency,** *Jo urnal of Computational Electronics,* 2021-10 | journal-article, DOI: 10.1007/s10825-021-01729-0

16. **Detection of foodborne pathogens using novel vertical capacitive sensors,** *Alexandria Engin eering Journal,* 2021-09 | journal-article, DOI: 10.1016/j.aej.2021.09.016

17. **Detection of Hepatocellular carcinoma in clinical specimens using Dielectrophoresis based ElectroKinetic Platform,** *Sensors and Actuators A: Physical* 2020-12 | journal-article DOI: 10.1016/j.sna.2020.112402

18. **Electrical characteristics of modified truncated cone nanowire for efficient light trapping,** *Ph otonics and Nanostructures - Fundamentals and Applications* 2020-02 | journal-article DOI: 10.1016/j.photonics.2019.100761

19. **Magnetic Field Effect on Threshold Voltage for Ultrathin Silicon Gate-All-Around Nanowire Fi eld-Effect-Transistors,** *Silicon,* 2020-01-04 | journal-article DOI: 10.1007/s12633-019-0097-0

20. **3D Analytical Modeling of Potential, Drain Current, and Threshold Characteristics for Long-C hannel Square Gate-All-Around (SGAA) MOSFETs,** *Recent Advances in Engineering Mathemati cs and Physics* 2020 | book-chapter DOI: 10.1007/978-3-030-39847-7_9

21. **Unified Quantum and Reliability Model for Ultra-Thin Double-Gate MOSFETs***Silicon* 2020 | journal-article DOI: 10.1007/s12633-019-0096-1

22. **Micro-electrodes based on CMOS Technology for Charactrization of Biological Cells***2019 IEEE International Symposium on Signal Processing and Information Technology (ISSPIT)* 2019-12 | conference-paper, DOI: 10.1109/isspit47144.2019.9001744

23. **Modeling of Double-gate LDMOSFET Devices including Self-heating***2019 31st International Conference on Microelectronics (ICM),* 2019-12 | conference-paper
DOI: 10.1109/icm48031.2019.9021451

24. **Planar Micro-electrodes versus Cone Plate for Biological Cell Trapping and Charcterization***2019 IEEE International Symposium on Signal Processing and Information Technology (ISSPIT),* 2019-12 | conference-paper
- DOI: 10.1109/isspit47144.2019.9001740

25. **Two-dimensional model for double-gate LDMOSFET devices,** *Journal of Computational Electronics,* 2019-09 | journal-article, DOI: 10.1007/s10825-019-01354-y

26. **CMOS-compatible hybrid bi-metallic TE/TM-pass polarizers based on ITO and ZrN***Applied Optics,* 2019-08-20 | journal-article, DOI: 10.1364/ao.58.006684

27. **A Novel Physical Modelling of FGMOSFET used in Circuit Simulators for Low-Power Systems and Optical Devices Applications***2019 36th National Radio Science Conference (NRSC),* 2019-04 | conference-paper, DOI: 10.1109/nrsc.2019.8734616

28. **Fast and accurate PV model for SPICE simulation***Journal of Computational Electronics*
2019-03-30 | journal-article
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29. **Unified Quantum and Reliability Model for Ultra-Thin Double-Gate MOSFETs***Silicon*
2019-02-06 | journal-article

30. **An electro-kinetic platform based on printed circuit Board technology for identification and characterization of biological cells,** *Microelectronic Engineering*
2019 | journal-article
DOI: 10.1016/j.mee.2019.02.001

31. **Charge Independent DC Model for Floating Gate MOSFET Used for Flash Memory and Electro-optic Switching Applications,** *Nonlinear Optics Quantum Optics*
2019 | journal-article
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32. **Impedance Analysis of Different Shapes of the Normal and Malignant White Blood Cells***2018 9th Cairo International Biomedical Engineering Conference, CIBEC 2018 - Proceedings*
2019 | conference-paper
DOI: 10.1109/CIBEC.2018.8641788

33. **The Effect of Different Surface Grating Shapes on Thin Film Solar Cell Efficiency,** *Proceedings of 2019 International Conference on Innovative Trends in Computer Engineering, ITCE 2019*
    2019 | conference-paper
    DOI: 10.1109/ITCE.2019.8646471

34. **Two-Dimensional models for quantum effects on short channel electrostatics of lightly doped symmetric double-gate MOSFETs***IET Circuits, Devices & Systems*
    2018-01-12 | journal-article
35. **A model of electrokinetic platform for separation of different sizes of biological particles,** *Advances in Intelligent Systems and Computing*
    2018 | book
    DOI: 10.1007/978-3-319-64861-3_11

36. **Optimum Design of PolyMUMPs Based Thermoelectric Generator Chip,** *Proceedings of the 2nd International Conference on Electronics, Communication and Aerospace Technology, ICECA 2018*
    2018 | conference-paper
    DOI: 10.1109/ICECA.2018.8474725

37. **Technology scaling roadmap for FinFET-based FPGA clusters under process variations,** *Journal of Circuits, Systems and Computers*
    2018 | journal-article
    DOI: 10.1142/S0218126618500561

38. **Thermal Resistance Model for Standard CMOS Thermoelectric Generator,** *IEEE Access*
    2018 | journal-article
    DOI: 10.1109/ACCESS.2018.2795382

39. **Two-dimensional models for quantum effects on short channel electrostatics of lightly doped symmetric double-gate MOSFETs,** *IET Circuits, Devices and Systems*
    2018 | journal-article, DOI: 10.1049/iet-cds.2017.0046

40. **An improved planar electrode for dielectric parameters extraction***National Radio Science Conference, NRSC, Proceedings*
    2017 | conference-paper, DOI: 10.1109/NRSC.2017.7893517

41. **Dielectric analysis of changes in electric properties of leukemic cells through travelling and negative dielectrophoresis with 2-D electrodes,** *Proceedings - IEEE International Symposium on Circuits and Systems*
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    DOI: 10.1109/ISCAS.2017.8050732

42. **A 2D compact model for lightly doped DG MOSFETs (P-DGFETs) including negative bias temperature instability (NBTI) and short channel effects (SCEs)***Microelectronics Reliability*
    2016-12 | journal-article
    DOI: 10.1016/j.microrel.2016.11.004

43. **Adipose Stem Cells Display Higher Regenerative Capacities and More Adaptable Electro-Kinetic Properties Compared to Bone Marrow-Derived Mesenchymal Stromal Cells,** *Scientific Reports*
    2016-11 | journal-article
    DOI: https://doi.org/10.1038/srep37801

44. **A 2D model of different electrode shapes for traveling wave dielectrophoresis,** *Proceedings of the International Conference on Microelectronics, ICM*
    2016 | conference-paper
    DOI: 10.1109/ICM.2016.7847864

45. **A 2D model of traveling wave Dielectrophoresis microelectrode array based on printed circu it board technology for manipulation and characterization of malignant and normal liver cell s,** *Proceedings of the 2016 4th International Japan-Egypt Conference on Electronic, Communicatio n and Computers, JEC-ECC 2016,* 2016 | conference-paper, DOI: 10.1109/JEC-ECC.2016.7518975

46. **A 3D model of quadrupole dielectrophoresis levitation,** *Midwest Symposium on Circuits and Systems*
    2016 | conference-paper, DOI: 10.1109/MWSCAS.2016.7870021

47. **A comparative evaluation of single-walled carbon nanotubes and copper in interconnects and Through-Silicon Vias,** *Proceedings of the IEEE International Conference on Electronics, Circuits, and Systems*
    2016 | conference-paper
    DOI: 10.1109/ICECS.2015.7440368

48. **Adipose stem cells display higher regenerative capacities and more adaptable electro-kineti c properties compared to bone marrow-derived mesenchymal stromal cells,** *Scientific Report s,* 2016 | journal-article
    DOI: 10.1038/srep37801

49. **Impact of technology scaling on the minimum energy point for FinFET based flip-flops***Proceedings of the IEEE International Conference on Electronics, Circuits, and Systems*
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50. **Optimal design of intermediate reflector layer in micromorph silicon thin-film solar cells,** *Journal of Nanophotonics*
2016 | journal-article
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51. **An analytical 3D model for short-channel effects in undoped FinFETs***Journal of Computational Electronics,* 2015 | journal-article
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52. **Analysis and optimization for dynamic read stability in 28nm SRAM bitcells,** *Proceedings - IEEE International Symposium on Circuits and Systems*
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53. **Lab on a chip based on CMOS technology: System architectures, microfluidic packaging, an d challenges,** *IEEE Design and Test,* 2015 | journal-article, DOI: 10.1109/MDAT.2015.2491785

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55. **Scaling of TG-FinFETs: 3-D Monte Carlo simulations in the ballistic and quasi-ballistic regimes,** *IEEE Transactions on Electron Devices*
2015 | journal-article, DOI: 10.1109/TED.2015.2420580

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2013 | journal-article
DOI: 10.1007/s11082-013-9696-y

60. **Continuous current and surface potential models for undoped and lightly doped double-gate metal-oxide-semiconductor field-effect transistors,** *Journal of Applied Physics*
2008 | journal-article
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2007 | conference-paper,

62. **A 3-D analytical physically based model for the subthreshold swing in undoped trigate FinFETs***IEEE Transactions on Electron Devices*
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2007 | journal-article
DOI: 10.1109/TED.2006.890595

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68. **Two-dimensional analytical threshold voltage and subthreshold swing models of undoped symmetric double-gate MOSFETs,** *IEEE Transactions on Electron Devices*
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DOI: 10.1109/TED.2005.852892

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2005 | conference-paper
DOI: 10.1063/1.2036747

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1998 | conference-paper

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