

Nayereh Ghobadi

Associate Professor
Electronics Engineering
Department of Electrical Engineering
University of Zanjan, University Blvd., Zanjan, I. R. Iran
Postal Code: 45371-38791
Phone: +98 24 3305 4216

Email: n.ghobadi@znu.ac.ir n.ghobadi@gmail.com

Homepage: [University of Zanjan](#) [ResearchGate](#)
[Google Scholar](#) [LinkedIn](#)

Research Interests

- Graphene and 2D Materials
- Ab-initio Calculations
- Spintronics
- Quantum Transport
- Photocatalysts
- Solar cells
- Sensors
- Semiconductor Devices

Education

Sep 2010 – Dec 2014 **University of Tehran** **Tehran, Iran**

Ph.D., Technology of Semiconductor Devices, Electronics, Electrical Engineering.

Thesis: Numerical Study of Field-Effect Tunneling Transistors Based on Vertical Graphene Heterostructures

Advisor: Prof. M. Pourfath and Prof. Y. Abdi

Sep 2006 – Feb 2009 **University of Tehran** **Tehran, Iran**

M.Sc., Technology of Semiconductor Devices, Electronics, Electrical Engineering.

Thesis: Investigation and Modeling of Reliability Challenges of the Nano-Devices

Advisor: Prof. Ali Afzali-Kusha and Prof. Ebrahim Asl Soleimani

Sep 2001 – Feb 2006 **Sharif University of Technology** **Tehran, Iran**

B.Sc., Electronics, Electrical Engineering.

Thesis: Artificial Neural Network Implementation on FPGA.

Advisor: Prof. Amirmansour Pezeshk

Publications

Journal Papers:

1. R. Karimi, S. Rahimi, Z. Khodayari, **N Ghobadi**, "Electronic structure and photocatalytic properties of Janus MXPY (M= Mo, W; X= S, Se; Y= Cl, Br) monolayers for high-efficiency overall water splitting," *Applied Surface Science*, vol. 727, p. 166005, 2026.
2. **N. Ghobadi**, S. G. Rudi, S. Soleimani-Amiri, "XMAY₂/GaZ (X= Cl, Br; M= Mg, Ca; A= Ga, In; Y= S, Se; Z= As, P, Sb) heterojunctions: Z-scheme structures for enhanced photocatalytic hydrogen evolution," *International Journal of Hydrogen Energy*, no. 186, p. 152007, 2025.
3. Z. Khodayari, R. Karimi, **N. Ghobadi**, "Computational design of sub-5 nm high-performance double-gate FETs based on two-dimensional Janus LiMSSe (M= Al, Ga, In) monolayers," *Applied Surface Science*, no. 716, p. 164730, 2025.
4. S. Soleimani-Amiri, S. Gholami Rudi, **N. Ghobadi**, "Janus MoXYCl (X= S, Se, Te; Y= N, P, As) monolayers: a promising family of 2D materials for high-performance p-i-n photodetectors and spintronic applications," *Nanoscale*, vol. 17, no. 28, pp. 16748-16766, 2025.
5. **N. Ghobadi**, S. Soleimani-Amiri, S. Gholami Rudi, "Direct Z-Scheme LiMXY/GaZ (M= Al, Ga, In; X= S, Se; Y= Se, Te; Z= P, As) van der Waals Heterostructures: Promising Photocatalysts with High Solar-to-Hydrogen Efficiency for Water Splitting," *ACS Applied Energy Materials*, vol. 8, no. 14, pp. 10234-10247, 2025.
6. **R. Karimi, N. Ghobadi**, "First-principles investigation of XMoSiY₂/XWSiY₂ and XMSiY₂/MoSeTe (X= Se, Te; M = Mo, W; Y = P, As) van der Waals heterostructures for high-efficiency photovoltaic applications," *Journal of Physics and Chemistry of Solids* 199, 112545, 2025
7. S. G. Rudi, S. Soleimani-Amiri, **N. Ghobadi**, "Prediction of Janus XYSTe (X= Li, Na; Y= Al, Ga, In) monolayers with tunable Rashba effect for spintronic devices," *Materials Science in Semiconductor Processing*, vol. 186, p. 109087, 2025.
8. **N. Ghobadi**, S. G. Rudi, S. Soleimani-Amiri, "First-Principles Investigation of Janus MgZnXY (X, Y=O, S, Se, Te; X≠Y) Monolayers for Short-Channel Field Effect Transistor," *ACS Applied Nano Materials*, vol. 7, no. 18, pp. 21747-21756, 2024.
9. S. Soleimani-Amiri, **N. Ghobadi**, S. G. Rudi, "Janus XMPYS (X= Se, Te; M= Mo, W; YAl, Ga) monolayers with enhanced spintronic properties and boosted solar-to-hydrogen efficiency for photocatalytic water splitting," *International Journal of Hydrogen Energy*, vol. 72, pp. 506-520, 2024.
10. **N. Ghobadi**, S. G. Rudi, S. Soleimani-Amiri, "Two-dimensional type-II XMoSiP₂/BAs (X= S, Se) van der Waals heterostructures for highly efficient excitonic solar cells," *Solar Energy Materials and Solar Cells*, vol. 269, p. 112779, 2024.
11. **N. Ghobadi**, A. Rezavand, S. Soleimani-Amiri, S. G. Rudi, "Surface-functionalization induced spintronic and photocatalytic features in group-III monochalcogenide monolayers: A first-principles study," *Applied Surface Science*, vol. 639, p. 158278, 2023.

12. S. G. Rudi, **N. Ghobadi**, S. Soleimani-Amiri, "Two-dimensional XMoSiP₂/BP (X= S, Se) Heterostructures as Efficient Photocatalysts for Overall Water Splitting," *Journal of Modeling in Engineering*, vol. 22, pp. 123-140, 2024.
13. S. G. Rudi, S. Soleimani-Amiri, **N. Ghobadi**, A. Rezavand, "Enhanced performance of Janus XMSiY₂ (X=S, Se; M=Mo, W; and Y=N, P) monolayers for photocatalytic water splitting via strain engineering," *Journal of Physics and Chemistry of Solids*, vol. 181, p. 111561, 2023.
14. S. Soleimani-Amiri, **N. Ghobadi**, A. Rezavand, S. G. Rudi, "First-principles prediction of two-dimensional Janus XMInZ₂ (X= Cl, Br, I; M= Mg, Ca; and Z= S, Se, and Te) with promising spintronic and photocatalytic properties," *Applied Surface Science*, vol. 623, p. 157020, 2023.
15. **N. Ghobadi**, S. G. Rudi, S. Soleimani-Amiri, "Electronic, spintronic, and piezoelectric properties of new Janus ZnAXY (A= Si, Ge, Sn, and X/Y = S, Se, Te) monolayers," *Physical Review B*, vol. 107, no. 7, p. 075443, 2023
16. **N. Ghobadi**, "Investigation of Electronic Properties and Interlayer Current Characteristics of Janus two-dimensional MoSi₂PmAsn and MoSi₂AsmSbn," *Journal of Modeling in Engineering*, vol. 20, no. 71, pp. 43-60, 2023
17. A. Rezavand, and **N. Ghobadi**, "First-principle study on quintuple-atomic-layer Janus MTeSiX₂ (M= Mo, W; X= N, P, As) monolayers with intrinsic Rashba spin-splitting and Mexican hat dispersion," *Materials Science in Semiconductor Processing*, vol. 152, p. 107061, 2022.
18. A. Rezavand, **N. Ghobadi**, and B. Behnamghader, "Electronic and spintronic properties of Janus MSi₂PxAsy (M = Mo, W) monolayers," *Physical Review B* 106, vol. 3, p. 035417, 2022.
19. **N. Ghobadi**, M. Hosseini, S. B. Touski, "Field-Effect Transistor Based on MoSi₂N₄ and WSi₂N₄ Monolayers Under Biaxial Strain: A Computational Study of the Electronic Properties," *IEEE Transactions on Electron Devices*, vol. 69, no. 2, pp. 863-869, 2022.
20. A. Rezavand, **N. Ghobadi**, "Tuning the Rashba spin splitting in Janus MoSeTe and WSeTe van der Waals heterostructures by vertical strain," *Journal of Magnetism and Magnetic Material*, vol. 544, 2022.
21. S. B. Touski, **N. Ghobadi**, "Vertical Strain-Induced Modification of Electrical and Spin Properties of Monolayer MoSi₂X₄ (X= N, P, As and Sb)", *Journal of Physics D: Applied Physics*, vol. 54, no. 48, 2021.
22. **N. Ghobadi**, S. B. Touski, "Structural, Electrical and Optical Properties of Bilayer SiX (X= N, P, As and Sb)", *Journal of Physics: Condensed Matter*, vol. 33, no. 8, 2021
23. A. Rezavand, **N. Ghobadi**, "Stacking-dependent Rashba spin-splitting in Janus bilayer transition metal dichalcogenides: the role of in-plane strain and out-of-plane electric field," *Physica E: Low-dimensional Systems and Nanostructures*, vol. 132, 2021.
24. S. B. Touski, **N. Ghobadi**, "Structural, Electrical and Rashba Properties of Monolayer Janus Si₂XY (X, Y = P, As, Sb and Bi)," *Phys. Rev. B*, vol. 103, no. 16, 2021.

25. **N. Ghobadi**, S. B. Touski, "The Electrical and Spin Properties of Monolayer and Bilayer Janus HfSSe under Vertical Electrical Field," *Journal of Physics: Condensed Matter*, vol. 33, no. 8, pp. 1-8, 2020
26. S. B. Touski, **N. Ghobadi**, "Interplay between stacking order and in-plane strain on the electrical properties of bilayer antimonene," *Physica E: Low-dimensional Systems and Nanostructures* 126, p. 114407, 2020.
27. M. Shamekhi, **N. Ghobadi**, "Band structure and Schottky barrier modulation in multilayer black phosphorene and black phosphorene/graphene heterostructure through out-of-plane strain", *Physica B: Condensed Matter*, vol. 580, pp. 1-9, 2020
28. **N. Ghobadi**, "Normal compressive strain-induced modulation of electronic and mechanical properties of multilayer MoS₂ and Graphene/MoS₂ heterostructure: A first-principles study", *Physica E: Low-dimensional Systems and Nanostructures*, vol. 111, pp. 158-166, 2019.
29. **N. Ghobadi**, "A comparative study of the mechanical properties of multilayer MoS₂ and graphene/MoS₂ heterostructure: effects of temperature, number of layers and stacking order", *Current Applied Physics*, vol. 17, no. 11, pp. 1483-1493, 2017.
30. **N. Ghobadi**, and A. Afzali-Kusha, "Investigation and Modeling of Negative Bias Temperature Instability (NBTI) and Hot Carrier Injection (HCI) Induced Degradation in Multi-Gate Nano-Devices," *Journal of Iranian Association of Electrical and Electronics Engineers*, vol. 12, no. 2, pp. 1-14, 2015
31. **N. Ghobadi**, and M. Pourfath, "Vertical Tunneling Graphene Heterostructure-Based Transistor for Pressure Sensing," *IEEE Electron Device Letters*, Vol. 36, No. 3, pp. 280-282, 2015.
32. **N. Ghobadi**, and M. Pourfath, "A Comparative Study of Tunneling FETs Based on Graphene and GNR Heterostructures," *IEEE Transactions on Electron Devices*, vol. 61, no. 1, pp. 186-192, Jan. 2014.
33. **N. Ghobadi**, and M. Pourfath, "On the Role of Disorder on Graphene and Graphene Nanoribbon-Based Vertical Tunneling Transistors," *Journal of Applied Physics*, vol. 116, p. 184506, 2014.
34. **N. Ghobadi**, and Y. Abdi, "Device Characteristics and Tight Binding Based Modeling of Bilayer Graphene Field-Effect Transistor," *Current Applied Physics*, vol. 13, no. 6, pp. 1082-1089, 2013.

Conference Papers:

1. M. Shamekhi, **N. Ghobadi**, "Elastic properties of Multilayer Phosphorene and Graphene/Phosphorene Heterostructure", *7th International Conference on Nanostructures (ICNS7)*, 27Feb-1 Mar 2018, Tehran, Iran.
2. **N. Ghobadi**, "Molecular Dynamics Simulation of Elastic Properties of Multilayer MoS₂ and Graphene/MoS₂ Heterostructure", *25th Iranian Conference on Electrical Engineering (ICEE)*, 4 - 2 May 2017, Tehran-Iran.
3. **N. Ghobadi**, "Investigation of Elastic properties of Multilayer MoS₂ under Vertical Compressive Strain," *13th Conference on Condensed Matter*, Physics Society of Iran, 2017

4. **N. Ghobadi**, “Strain Effect on the Device Characteristics of Vertical Tunneling Graphene Heterostructure-Based Transistor,” *24th Iranian Conference on Electrical Engineering (ICEE)*, 10-12 May 2016, Shiraz, Iran.
5. **N. Ghobadi**, and M. Pourfath, “A Computational Study of Line-Edge Roughness in Tunneling FETs Based on GNR Heterostructures,” *6th International Conference on Nanostructures (ICNS6)*, 7-10 March 2016, Kish Island, Iran.
6. **N. Ghobadi**, and M. Pourfath, “Numerical Study of Tunneling FETs Based on Vertical Graphene Heterostructures,” *5th International Conference on Nanostructures (ICNS5)*, 6-9 March 2014, Kish Island, Iran.
7. **N. Ghobadi**, A. Afzali-Kusha, and E. Asl-Soleimani, “Analytical Modeling of Hot Carrier Injection Induced Degradation in Triple Gate Bulk FinFETs,” *in the Proceeding of the 1st Asia Symposium on Quality Electronic Design (ASQED 2009)*, pp. 28-34, Jul. 2009, Kuala Lumpur, Malaysia.
8. **N. Ghobadi**, A. Afzali-Kusha, and E. Asl-Soleimani, “Modeling Effect of Negative Bias Temperature Instability on Potential Distribution and Degradation of Double-gate MOSFETs,” *in the Proceeding of the 10th International Conference on Ultimate Integration of Silicon (ULIS 2009)*, pp. 313-316, Mar. 2009, Aachen, Germany.
9. **N. Ghobadi**, A. Afzali-Kusha, and E. Asl-Soleimani, “Analytical Modeling of Negative Bias Temperature Instability in Triple Gate MOSFETs,” *in the Proceeding of the 10th International Conference on Ultimate Integration of Silicon (ULIS 2009)*, pp. 309-312, Mar. 2009, Aachen, Germany.
10. **N. Ghobadi**, A. Afzali-Kusha, and E. Asl-Soleimani, “Modeling of Floating-Body Effect on Negative Bias Temperature Instability Degradation of Double-gate MOSFETs,” *in the Proceeding of 18th Iranian Conference on Electrical Engineering (ICEE 2010)*, May. 2010, Isfahan, Iran.
11. **N. Ghobadi**, A. Afzali-Kusha, and E. Asl-Soleimani, “Modeling of Hot Carrier Induced Substrate Current and Degradation in Triple Gate Bulk FinFETs,” *in the Proceeding of 18th Iranian Conference on Electrical Engineering (ICEE 2010)*, May. 2010, Isfahan, Iran.
12. **N. Ghobadi**, R. Majidi, M. Mehran and A. Afzali-Kusha, “Low Power 4-Bit Full Adder Cells in Subthreshold Regime,” *in the Proceeding of 18th Iranian Conference on Electrical Engineering (ICEE 2010)*, May. 2010, Isfahan, Iran.
13. **N. Ghobadi**, A. Afzali-Kusha, and E. Asl-Soleimani, “Investigation and Modeling of Reliability Challenges of the Nano-Devices,” *in the Proceeding of the 6th Nanotechnology Iranian Student Conference (NISC)*, Dec. 2009, Tehran, Iran.

Research Projects

1. “Prediction of a novel Two-Dimensional Janus material with strong spin-orbit coupling effect as highly efficient photocatalyst for water splitting”, Colleague, Iran National Science Foundation (INSF), 2023.
2. “Novel Two-Dimensional Janus XMSiY₂ (X=S, Se; M=Mo, W; Y=N, P) as Highly Efficient Photocatalysts for Water Splitting”, Leader, University of Zanjan, 2023.

3. “Electronic, spintronic and piezoelectric properties of Janus ZnAXY (A = Si, Ge, Sn, and X/Y = S, Se, Te) monolayers and their applications in spintronic and piezoelectric sensors”, Colleague, Babol Noshirvani University of Technology (NIT), 2022.

Honors and Awards

- Best Young Researcher Award from the University of Zanjan (2023)
- Supervision of best M.Sc. thesis (Academic Award) among master’s students at the University of Zanjan (2022)
- Best teaching award from the University of Zanjan (2020).
- Recipient of the “Outstanding Student” Academic Award from the University of Tehran: Admission to Ph.D. Program and Exemption from Taking the Nationwide University Entrance Exam for Ph.D. (2010).
- Ranked Top 0.5% among about 20,000 Participants in the Nationwide University Entrance Exam of Electrical Engineering for M.Sc. in the Field of Electronics (2006).
- Ranked Top 0.1% among about 500,000 Participants in the Nationwide University Entrance Exam for B.Sc. in Mathematics and Physics (2001).

Work Experiences

- University of Zanjan (Jan 2015-Now)
 - Associate Professor of the Department of Electrical and Computer Engineering.
- Parman Company (Dec 2005-Sep 2010):
 - Working as a software team programmer and contributing to the design, development, and testing of embedded software (C++) of:
 - Compact and modular STM-1 and STM-4 systems based on ITU-T recommendations.
 - Ethernet over SDH system.
 - Design and implementation of AVR Microcontroller software to drive a Touch Screen LCD for monitoring the STM-1 system.
 - Design and implementation of GSM Network Quality monitoring software using Visual C++.
- Pars Research Center (Fall 2005)

Teaching Experience

University of Zanjan:

- Theory and Technology of Fabrication of Semiconductor Devices
- Semiconductor Devices
- Electronics Physics
- Electronics I
- Electronics II

- Electronics I Lab

Supervisor of Projects

M.Sc:

1. Mehdi Shamekhi, “Numerical Study of Electronic and Mechanical Properties of Graphene/Phosphorene Heterostructure”, September 2019.
2. Amirhossein Rezavand, “Investigation of electronic and spintronic properties of Janus transition metal dichalcogenides in the presence of spin-orbit coupling”, January 2022.
3. Behnaz Behnam Ghader “Investigation of the effect of strain on the electrical and spin properties of Janus ternary compounds of group IV-V and transition metal elements”, September 2022.
4. Hossein Shahbazi, “Pressure sensor based on two-dimensional compounds of group IV and V elements using first principle calculations”, September 2022.
5. Matineh Javadiha, “Investigation of electrical, optical and photocatalytic properties of two-dimensional heterostructures based on ClMgInS_2 and ClZnInS_2 ”, July 2024.
6. Hadi Ghoojaei, “Schottky barrier modulation in heterostructure of Graphene and Janus two-dimensional compounds of group IV and V elements through strain and electric field”, In progress.
7. Reza Karimi, “Prediction of heterostructures based on Janus two-dimensional XMSiP_2 ($\text{X}=\text{Se}, \text{Te}$; $\text{M}=\text{Mo}, \text{W}$) for application in solar cells”, 2025.
8. Zahra Khodayari, “Design and Simulation of Sub-5 nm Gate-Length High-Performance Field-Effect Transistor Based on Two-Dimensional Janus LiMSSe ($\text{M}=\text{Al}, \text{Ga}, \text{In}$)”, 2026.

Technical Skills

- Ab-initio calculation using QuantumATK, SIESTA, and Quantum Espresso.
- Programming Skills: Python, C/C++, MATLAB.
- Molecular dynamics (MD) simulation using LAMMPS package.
- Device and Fabrication simulator: Silvaco, and Sentaurus Device.
- Analyzing analog circuits using PSpice, and HSpice.