Muhammad Ali Siddiqi

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Work Experience

2023–present **Lahore University of Management Sciences (LUMS), Pakistan,** Assistant Professor, Department of Electrical Engineering

- Supervising B.S., M.Sc. and Ph.D. students (from LUMS, TU Delft and Erasmus MC)
- Teaching in multiple courses

2021–2023 **Delft University of Technology (TU Delft), The Netherlands,** Postdoc Researcher, Department of Quantum and Computer Engineering (QCE)

- Design of ultra-low-power-computing architectures for next-generation neural implants
- Design of compact, fast and energy efficient hardware for performing real-time brain simulations
- Active participation in the H2020 EU projects: SEPTON and SECURED
- Supervising M.Sc. and Ph.D. students
- Teaching in multiple courses

2017–2021 **Erasmus Medical Center, Rotterdam, The Netherlands,** Ph.D. Candidate, Department of Neuroscience

- Design of secure-communication protocols for reader-IMD systems and MBANs
- Focus on battery-depletion attacks, emergency access, non-repudiation and technical debt
- Active participation in the H2020 EU projects: SDK4ED and SHARCS
- Supervising M.Sc. students
- Teaching in multiple courses

2012–2017 **Silicon Labs Norway (previously Energy Micro),** Design Engineer

- Specification, design and verification of digital peripherals in microcontroller and radio system-on-chip products. Examples include the Protocol Timer and Cryotimer, which are part of the Wireless Gecko EFR32^{TM} SoCs
- Tasks: Top-level (system) verification, low-power digital design and verification, RTL synthesis, static timing analysis, technical documentation

2009–2010 **Lahore University of Management Sciences (LUMS), Pakistan,** Research Assistant, Department of Computer Science

- Implementation of efficient sample-rate converters for software defined radios
- Implementation of adaptive delta-sigma modulators

Education

2017–2021 **Erasmus University Rotterdam, The Netherlands,** Doctor of Philosophy
Thesis: *On the Security and Privacy of Implantable Medical Devices*

2010–2012 **Norwegian University of Science and Technology & University of Southampton, UK,** Erasmus Mundus Masters in Embedded Computing Systems (EMECS)
Master project (at Cambridge Silicon Radio, UK): *Analysing the effects of Standard Cell Utilization on the Post-layout timing for a high performance ARM CPU core using a 40 nm CMOS process*
Average Grade: *A (Highest)*

2005–2009 **National University of Sciences and Technology, Pakistan,** BE Electrical (Telecommunications) Engineering
BE Project: *Implementation of a Cognitive Radio System for Dynamic Spectrum Access*
CGPA: *3.95/4.0 (Highest)*

Research Interests

IMD/MBAN/IoT security	Brain-computer interfaces	Next-generation medical implants
Neuromorphic computing	Edge computing	HW-based brain simulation

Research Publications

Thesis

1. **Siddiqi, M. A.** (2021, September). *On the Security and Privacy of Implantable Medical Devices* (Doctoral dissertation, Erasmus University Rotterdam). Retrieved from http://hdl.handle.net/1765/135700

Patents

1. **Siddiqi, M. A.**, Strydis, C., & De Zeeuw, C. I. (2023a, January). Implantable Medical Device and Control Device Therefor. NL Patent 2028563.
2. **Siddiqi, M. A.**, Strydis, C., & De Zeeuw, C. I. (2023b, January). Implantable Medical Device and Control Device Therefor. NL Patent 2028564.

Journal Articles

1. Gebregiorgis, A., Yousefzadeh, A., Eissa, S., **Siddiqi, M. A.**, Frenkel, C., Zenke, F., … Corradi, F. (2025). Spike-based neuromorphic computing: An overview from bio-inspiration to hardware architectures and learning mechanisms. *Microprocessors and Microsystems*, 105240. doi:10.1016/j.micpro.2025.105240
2. Landsmeer, L., Hua, E., Abunahla, H., **Siddiqi, M. A.**, Ishihara, R., De Zeeuw, C. I., … Strydis, C. (2025). Efficient implementation of the hodgkin-huxley potassium channel via a single volatile memristor. *Frontiers in Neuroscience*, *19*, 1569397. doi:10.3389/fnins.2025.1569397
3. Landsmeer, L. P. L., **Siddiqi, M. A.**, Abunahla, H., Negrello, M., Hamdioui, S., & Strydis, C. (2025). Efficient and realistic brain simulation: A review and design guide for memristor-based approaches. *Advanced Materials Technologies*, *e01587*. doi:10.1002/admt.202401587
4. Vermeulen, J. J., Krivoshein, G., Diware, S., **Siddiqi, M. A.**, van den Maagdenberg, A. M., Tolner, E. A., … Bishnoi, R. (2025). Classification of epileptiform activity in an intrahippocampal kainic acid mouse model. *Discover Applied Sciences*, *7*(10), 1065. doi:10.1007/s42452-025-07544-7

5. De Ridder, D., **Siddiqi**, **M. A.**, Dauwels, J., Serdijn, W. A., & Strydis, C. (2024). Neurodots: From single-target to brain-network modulation: Why and what is needed? *Neuromodulation: Technology at the Neural Interface*. doi:10.1016/j.neurom.2024.01.003

6. Siavvas, M., Tsoukalas, D., Marantos, C., Papadopoulos, L., Lamprakos, C., Matei, O., … Filus, K. et al. (2024). Sdk4ed: A platform for building energy efficient, dependable, and maintainable embedded software. *Automated Software Engineering*, *31*(2), 1–71. doi:10.1007/s10515-024-00450-z

7. **Siddiqi**, **M. A.**, Hahn, G., Hamdioui, S., Serdijn, W. A., & Strydis, C. (2022). Improving the Security of the IEEE 802.15.6 Standard for Medical BANs. *IEEE Access*, *10*, 62953–62975. doi:10.1109/ACCESS.2022.3181630

8. **Siddiqi**, **M. A.**, Beurskens, R. H. S. H., Kruizinga, P., De Zeeuw, C. I., & Strydis, C. (2021). Securing Implantable Medical Devices Using Ultrasound Waves. *IEEE Access*, *9*, 80170–80182. doi:10.1109/ACCESS.2021.3083576

9. **Siddiqi**, **M. A.**, Serdijn, W. A., & Strydis, C. (2021). Zero-Power Defense Done Right: Shielding IMDs from Battery-Depletion Attacks. *Journal of Signal Processing Systems*, *93*(4), 421–437. doi:10.1007/s11265-020-01530-5

10. **Siddiqi**, **M. A.**, Doerr, C., & Strydis, C. (2020). IMDfence: Architecting a Secure Protocol for Implantable Medical Devices. *IEEE Access*, *8*, 147948–147964. doi:10.1109/ACCESS.2020.3015686

Magazine Articles

1. Strydis, C., & **Siddiqi**, **M. A.** (2024). Brain gain or brain drain? the risky rise of connected neural implants. *HiPEAC info*, *72*. Retrieved from https://www.hipeac.net/magazine/7168.pdf

Conference Proceedings

1. Zeeshan, M., Bina, L., Bosman, L. W., De Zeeuw, C. I., **Siddiqi**, **M. A.**, & Taj, M. (2026). Deep spatio-temporal models for decoding purkinje cell activity in tongue movements. In *2026 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)* (pp. 6871–6875). IEEE. doi:10.1109/ICASSP55912.2026.11463094

2. Fatima, K., Romano, V., Strydis, C., & **Siddiqi**, **M. A.** (2025). Real-Time, Low-Power Purkinje Cell Spike Sorting for Headstage Systems in Freely Moving Mice. In *2025 21st IEEE Biomedical Circuits and Systems Conference (BioCAS)*. IEEE. doi:10.1109/BioCAS67066.2025.00067

3. Regazzoni, F., Acs, G., Aszalos, A. Z., Avgerinos, C., Bakalos, N., Berral, J. L., … Fournaris, A. P. (2024). Secured for health: Scaling up privacy to enable the integration of the european health data space. In *2024 Design, Automation & Test in Europe Conference & Exhibition (DATE)* (pp. 1–4). IEEE. doi:10.23919/DATE58400.2024.10546514

4. **Siddiqi**, **M. A.**, Vrijenhoek, D., Landsmeer, L. P. L., van der Kleij, J., Gebregiorgis, A., Romano, V., … Strydis, C. (2024). A Lightweight Architecture for Real-Time Neuronal-Spike Classification. In *2024 21st ACM International Conference on Computing Frontiers (CF'24)*. ACM. doi:10.1145/3649153.3649186

5. **Siddiqi**, **M. A.**, Hernández, J. A. G., Gebregiorgis, A., Bishnoi, R., Strydis, C., Hamdioui, S., & Taouil, M. (2023). Memristor-based lightweight encryption. In *2023 26th euromicro conference on digital system design (dsd)* (pp. 634–641). IEEE. doi:10.1109/DSD60849.2023.00092

6. **Siddiqi**, **M. A.**, Tsintzira, A.-A., Digkas, G., Siavvas, M., & Strydis, C. (2021). Adding security to implantable medical devices: Can we afford it? In *Proceedings of the 2021 International Conference on Embedded Wireless Systems and Networks* (pp. 67–78). Delft, The Netherlands: Junction Publishing.

7. **Siddiqi**, **M. A.**, & Strydis, C. (2019a). IMD Security vs. Energy: Are We Tilting at Windmills? POSTER. In *Proceedings of the 16th ACM International Conference on Computing Frontiers* (pp. 283–285). doi:10.1145/3310273.3323421

8 **Siddiqi, M. A.**, & Strydis, C. (2019b). Towards Realistic Battery-DoS Protection of Implantable Medical Devices. In *Proceedings of the 16th ACM International Conference on Computing Frontiers* (pp. 42–49). doi:10.1145/3310273.3321555

9 **Siddiqi, M. A.**, Seepers, R. M., Hamad, M., Prevelakis, V., & Strydis, C. (2018). Attack-tree-based Threat Modeling of Medical Implants. In *PROOFS 2018. 7th International Workshop on Security Proofs for Embedded Systems* (Vol. 7, pp. 32–49). doi:10.29007/8gxh

10 Athar, S., **Siddiqi, M. A.**, & Masud, S. (2012). Teaching and research in FPGA based Digital Signal Processing using Xilinx System Generator. In *2012 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)* (pp. 2765–2768). doi:10.1109/ICASSP.2012.6288490

11 Athar, S., **Siddiqi, M. A.**, & Masud, S. (2010). Design and FPGA Implementation of a 2nd Order Adaptive Delta Sigma Modulator with One Bit Quantization. In *2010 International Conference on Field Programmable Logic and Applications* (pp. 388–393). doi:10.1109/FPL.2010.82

12 **Siddiqi, M. A.**, Samad, N., Masud, S., & Sheikh, F. (2010). FPGA-based Implementation of Efficient Sample Rate Conversion for Software Defined Radios. In *2010 10th IEEE International Conference on Computer and Information Technology* (pp. 2387–2390). doi:10.1109/CIT.2010.410

Funding and Support

2026 **Decommissioned Implantable Medical Devices for Cybersecurity Research,** In-kind Donation, Erasmus Medical Center, Rotterdam, The Netherlands
Items: Pacemakers and implantable cardioverter-defibrillators (ICDs)
Role: PI
Estimated Value: *EUR 50,000*

2026 IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Barcelona, Spain LUMS-funded, Faculty Travel Grant (FTG) [Grant no. 1442].
Role: Author/Presenter
Budget: *PKR 1,233,000*

Edge-Enabled, Context-Aware IoT for Sustainable Flash Flood Monitoring, LUMS-funded, Faculty Initiative Fund (FIF) [Grant no. 1047].
Role: PI
Budget: *PKR 1.5 Million*

2025 **21st IEEE Biomedical Circuits and Systems Conference (BioCAS), Abu Dhabi, UAE** LUMS-funded, Faculty Travel Grant (FTG) [Grant no. 1358].
Role: Author/Presenter
Budget: *PKR 878,000*

Beyond the Firewall: A Hybrid Approach to Combat Port-Scan Threats in Real Time, LUMS-funded, Faculty Initiative Fund (FIF) [Grant no. 0961].
Role: PI
Budget: *PKR 1.5 Million*

2024 **Mice on the Move: Advancing Cerebellar Neuroscience through Wireless Head Stages,** LUMS-funded, Faculty Initiative Fund (FIF) [Grant no. 0876].
Role: PI
Budget: *PKR 1.5 Million*

2023–2026 **Scaling Up secure Processing, Anonymization and generation of Health Data for EU cross border collaborative research and Innovation (SECURED),** EU-funded, Horizon Health RIA project [Grant agreement no. 101095717].
Role: Co-PI and work-package leader
Budget: *EUR 4.9 Million* (100% EC contribution)

Funding and Support (continued)

- **Security Protection Tools for Networked Medical Devices (SEPTON),** EU-funded, Horizon Health RIA project [Grant agreement no. 101094901].
  Role: Co-PI and work-package leader
  Budget: *EUR 7.0 Million* (100% EC contribution)

Academic Services and Conference Committees

2026
- **Pakistan Semiconductor Summit (PSS)** *Program Committee (PC) member*
- **Pakistan Semiconductor Summit (PSS)** *Hackathon Chair*

2024–present
- **Reconfigurable Architectures Workshop (RAW)** *Program Committee (PC) member*
- **Minor in Computer Engineering,** SBASSE, LUMS, *Program coordinator*
- **Early Career Researcher Committee,** SBASSE, LUMS

2023–present
- **EE Undergraduate Committee,** SBASSE, LUMS
- **Ph.D. Defense Committee,** *Fatima Hameed Khan,* SBASSE, LUMS
- **MS Thesis Evaluation Committees,** SBASSE, LUMS, *Students: Sami Ullah Saqib, Ahmad Jamal, Shahzaib Naveed, Aqsa Ali, M. Mudasser Latif Minhas, Sharon Samson*

2024
- **IEEE Workshop on Control and Modeling for Power Electronics (COMPEL)** *Chair Attendee Facilitation Committee*

Peer Reviewing

2026
- IEEE International NEWCAS Conference

2024–2026
- Reconfigurable Architectures Workshop (RAW)

2025–2026
- ACM Transactions on Reconfigurable Technology and Systems

2023
- Design Automation Conference (DAC)
- IEEE International Symposium on Circuits and Systems (ISCAS)
- Design Automation and Test in Europe (DATE)

2019, 2023
- International Conference on Field Programmable Logic and Applications (FPL)

2022
- IEEE International Conference on Application-specific Systems, Architectures and Processors (ASAP)

2017–2021
- International Conference on Embedded Computer Systems: Architectures, Modeling, and Simulation (SAMOS)

2020
- IEEE Transactions on Sustainable Computing
- IEEE Latin American Symposium on Circuits and Systems (LASCAS)

2019
- IEEE Transactions on Emerging Topics in Computing
- IEEE Transactions on Biomedical Circuits and Systems (TBioCAS)

2018–2019
- Workshop on Cryptography and Security in Computing Systems (CS2)

Invited Talks and Panel Discussions

2026
- **The Sensor that Learned to Sleep** Invited lecture, LUMS Math Circles
- **Welcome Address** Delivered the opening address on behalf of LUMS to 500+ stakeholders from industry and academia at the *2nd Pakistan Semiconductor Summit*

2025
- **Medical IoT Security** Invited talk, CS677 Internet of Things

Invited Talks and Panel Discussions (continued)

- **PhD opportunities in STEM outside the United States** Panel discussion held by the LUMS Office of Student Affairs

2024 — **The Moving Science Frontier: Embedded Systems** Invited talk, LUMS Science Symposium

2022 — **Improving the Security of the IEEE 802.15.6 Standard for Medical BANs** Invited talk, P802.15 Working Group for Wireless Specialty Networks, WBAN Task Group 802.15.6a

Teaching Experience

2026–present — **CS677 Internet of Things,** LUMS

2025–present — **EE5204 Applied Cryptography,** LUMS

2024–present — **EE341 Microelectronic Design,** LUMS

EE5202 VLSI Design for AI, LUMS

2023–2024 — **EE5216 Hardware Design for IoT Security,** LUMS

2020–2023 — **EE4555 Active Implantable Biomedical Microsystems,** TU Delft, *Lectures on IMD security*

2017–2022 — **TM12003 Electrostimulation of Neurophysiological Systems,** TU Delft, *Lectures on IMD digital design, reliability and security*

Supervision Experience

Ph.D. Students

2025–present — **Ph.D. supervisor – Mohammad Wajahat Riaz Mirza, LUMS,** *Working title: RISC-V Extensions for Neuromorphic Computing*

2024–present — **Ph.D. supervisor – Muhammad Asim Javaid, LUMS,** *Working title: Post-Quantum Cryptography on Edge Devices*

2023–present — **Ph.D. co-supervisor – Lennart Landsmeer, TU Delft / Erasmus MC,** *Working title: Memristor-Based Brain Simulation*

Staff/RAs

2026–present — **Mohammad Fahad, LUMS,** *FPGA-Based SYN Scan Detection*

2025–present — **Ayesha Javaid, LUMS,** *FPGA-Based SYN Scan Detection*

Afsah Syed, LUMS, *Decoding Continuous Fine Motor Control from Single-Channel Cerebellar Local Field Potentials*

2024–2025 — **Mishal Arif, LUMS,** *Neuronal Spike Classification using Spiking Neural Networks* ***[Placement: 10x Engineers]***

2023–2024 — **Asfandyar Akbar, LUMS,** *Deep Learning–Based Image Compression for Functional Ultrasound Images*

Muhammad Usman Nadeem, LUMS, *Real-Time Detection of IP-Scanning Attacks* ***[Placement: Utah State University, USA]***

M.Sc. Students

2025–2026 — **M.Sc. thesis supervisor – Ibraheem Qadir, LUMS,** *A Real-Time System for Detecting Stealthy TCP SYN Scans*

2024–2025 — **M.Sc. thesis co-supervisor – Muhammad Zeeshan, LUMS,** *Decoding Purkinje Cell Activity for Cerebellar Control of Movement* ***[Placement: LUMS]***

Supervision Experience (continued)

- **M.Sc. thesis supervisor – Faisal Saeed, LUMS,** *Automated FPGA Design for Real-Time Stealth SYN Scan Detection* ***[Placement: CoMira Solutions Inc.]***
- **M.Sc. thesis supervisor – Kiran Fatima, LUMS,** *Embedded Real-Time Spike Classification for Purkinje Cells* ***[Placement: Cedar Instruments Co.]***

2023–2024
- **M.Sc. thesis co-supervisor – Jeroen Vermeulen, TU Delft,** *Real-Time Classification of Epileptiform Activity in the Intrahippocampal Kainic Acid Mouse Model*
- **M.Sc. thesis co-supervisor – Job van der Kleij, TU Delft,** *Exploring the use of FPGAs in Implantable Medical Devices*

2021–2023
- **M.Sc. thesis co-supervisor – David Vrijenhoek, TU Delft,** *Real-Time Detection and Classification of Purkinje-Cell Neural Activity*

2021–2022
- **M.Sc. thesis co-supervisor – Jan Andres Galvan Hernandez, TU Delft,** *Memristor-Based Encryption for Free-Floating Neural Implants*

2020–2021
- **M.Sc. thesis co-supervisor – David Veselka, TU Delft,** *Exploring Feasibility of FPGAs in Implantable Medical Devices*
- **M.Sc. thesis co-supervisor – Georg Hahn, TU Delft,** *Assessing the state of security of Medical BANs and the IEEE 802.15.6 standard*

2018–2020
- **M.Sc. thesis co-supervisor – Vasileios Skrekas, TU Delft,** *Industry Compliant Wireless Power and Data Transfer Module Towards Ensuring Battery Denial of Service Protection*
- **M.Sc. thesis co-supervisor – Michal Loin, TU Delft,** *An Authentication Protocol for Implantable Medical Devices*

B.S. Students

2026
- **Directed research project supervisor** – Maaz Shahid, **LUMS,** *Resource-Aware Secure Multiparty Computation for IoT Systems*
- **Directed research project supervisor** – Karar Haider, **LUMS,** *Cybersecurity and Privacy Landscape of Pakistan*
- **Directed research project supervisor** – Burhan Ahmad Khan, Saim Bilal, **LUMS,** *Practical Fully Homomorphic Encryption for Federated Learning on IoT Devices*
- **Directed research project supervisor** – Khadeeja Nomaan, Zainab Aziz, **LUMS,** *Security Vulnerabilities in Commercial Medical Implants*

2025–2026
- **Senior project supervisor** – M. Ali Malik Noon, Sheikh Shahzaib Ali, Muhammad Musa Shehzad, **LUMS,** *Neuronal Spike Classification using Spiking Neural Networks*
- **Senior project supervisor** – Arooba Farhan, M. Ahsan Salar Khan, M. Areeb Khalid Kidwai, **LUMS,** *Neuromorphic Hardware for Neuronal Spike Classification*
- **Senior project supervisor** – Mishaal Khalid, Fatima Amir, **LUMS,** *Context-Aware IoT for Environmental Monitoring*
- **Senior project supervisor** – M. Fahd Ibrahim Bhatti, **LUMS,** *Background-Aware Neural Image Compression for Wildlife Edge Systems*
- **Senior project supervisor** – Sheikh Rayaan Sohaib, **LUMS,** *Smart Shoulder: An IMU-Enabled Wearable System for Real-Time Fitness Injury Prevention*
- **Senior project supervisor** – Hamza Nouman Idris Yoshida, **LUMS,** *Security Analysis of NFC-Based Out-of-Band Channels for Bluetooth LE Pairing*
- **Senior project co-supervisor** – Muizz Ahmed Hussain, Muhammad Sohaf Khan, **LUMS,** *Deep Learning–Based Image Compression for Functional Ultrasound Images*

Supervision Experience (continued)

2025
- **Directed research project supervisor** – Faaiz Umer, M. Shafay Tanveer Hassan, **LUMS,** *Incorporating Post-Quantum Cryptography into Bluetooth LE Pairing* ***[Admission offer: Arizona State University, USA]***
- **Directed research project supervisor** – Saadi Humayun, **LUMS,** *Deep Learning–Based Image Compression for Functional Ultrasound Images*
- **Summer research supervisor** – Shazreen Rashid, **LUMS,** *Decoding Continuous Fine Motor Control from Single-Channel Cerebellar Local Field Potentials*

2024–2025
- **Senior project supervisor** – Maheer Kashif, M. Faizan, Areeb Zahid, Ushna Saeed, **LUMS,** *Low Power, AI-Enabled Edge Computing* ***[Placements: i2c Inc., Powersoft19]***

2023–2024
- **Senior project supervisor** – Hamza Saleem, Syed Muqeem Mahmood, Muhammad Faizan Owais, **LUMS,** *Spike Sorting Algorithm for Purkinje Cells* ***[Placements: Queen's University, Canada; LUMS; 10Pearls]***

2019–2021
- **Co-supervision of 10 B.Sc. students' final projects, TU Delft**

Others

2025
- **RISE internship supervisor** – Aliza Jafree, Rahma Hatim, **LUMS,** *Bioelectronic Prosthetics: Simulating Motion Through Code and Sensors*

2013–2016
- **Supervision of 7 summer interns, Silicon Labs Norway**

Technical Skills

Coding	C, Python, Verilog, SystemVerilog, VHDL, LaTeX
Microcontrollers	Silicon Labs EFM32, EFR32 (based on ARM Cortex-M0+/M3/M4)
Design methodologies	Common Power Format (CPF)-based verification, Constrained Random Verification along with SystemVerilog assertions (SVA), Gate-Level (netlist) Simulation, Static Timing Analysis (STA)
Design tools	*ASIC:* Cadence SimVision, Encounter RTL Compiler, Tempus, LTspice *FPGA:* ModelSim, Aldec Active-HDL, Xilinx (ISE, System Generator for DSP), Synopsys Synplify Pro *Others:* MATLAB, Simplicity Studio, AVISPA, IAR, GNU Radio

Certifications

2024–2025
- **Faculty Success Series,** *Awarded by LUMS Learning Institute (LLI)*
- **Faculty Certificate in Teaching and Learning (FCTL),** *Awarded by LUMS Learning Institute (LLI)*

Honors & Awards

2012
- M.Sc. degree graduated with the highest grade (A)

2010–2012
- Erasmus Mundus Master Scholarship

2009
- President's Gold Medal for obtaining the highest CGPA in the BE studies

2005–2009
- National University of Sciences and Technology (NUST) Merit Scholarship