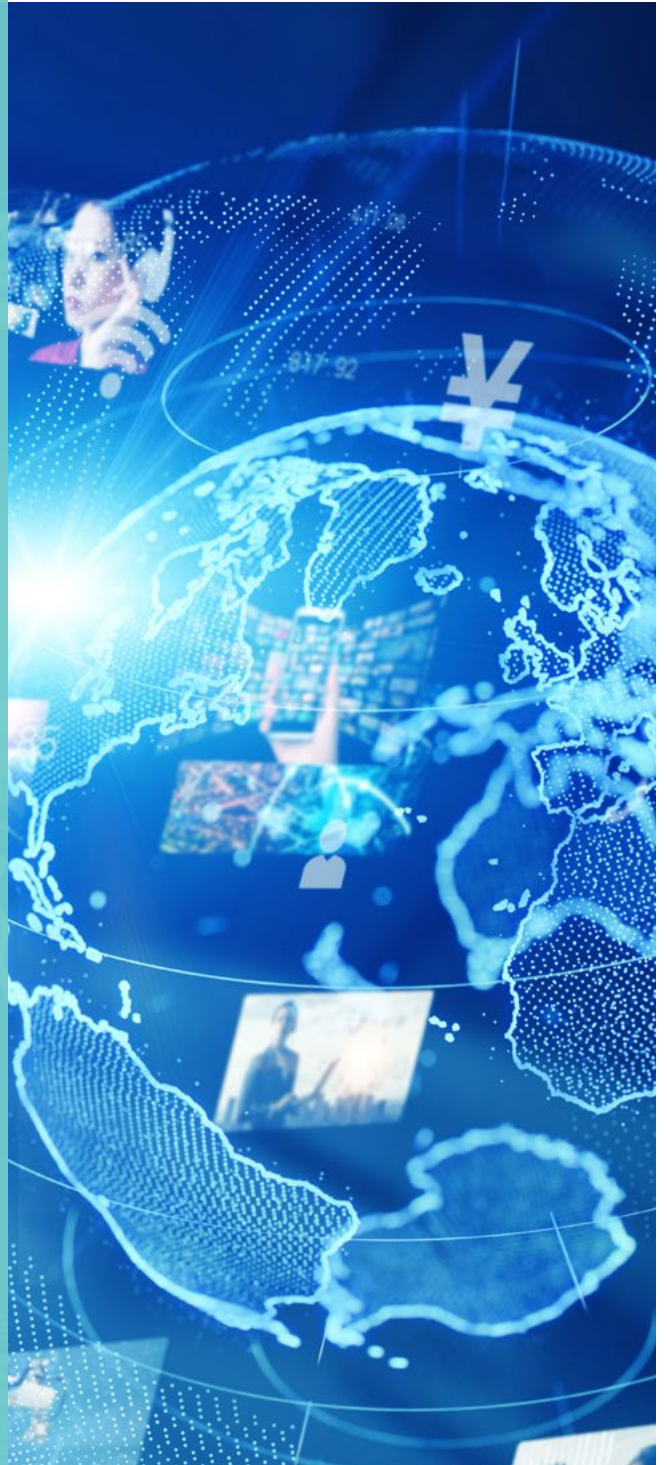


ANNUAL REPORT 2023



 **MCCI**
SOLVE THE IMPOSSIBLE

**TECHNOLOGY
CENTRE** 
ENTERPRISE IRELAND
IDA IRELAND SUPPORTED



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Chairperson's Message

Chairperson's Message

Throughout 2023, MCCI has advanced its position as a key driver of industry-led research and development in the semiconductor technology sector. MCCI is a €10M per annum performing centre with a team of close to 90 researchers in microelectronics in Ireland. The microelectronics sector in Ireland employs approximately 20,000 people and generates €15 billion in direct export revenue.

Over the past 13 years, MCCI's researchers have produced world renowned research excellence and generated direct employment transfers to Industry in IC design jobs in Ireland. MCCI develops the IC design talent to drive this sector and it has continued to succeed in 2023 with the 100th person transferring to Industry. The team are motivated and developed by talented senior researchers who are focused on delivering essential application and system level solutions that are very relevant to Industry.

MCCI is hosted in the Tyndall National Institute where the team collaborates with prominent research groups in Photonics, Materials Science, Electrochemistry and Medical Devices. The collaborative synergy is unique and serves as a cornerstone for future growth. The teamwork with industry and academic partners to bridge the gap between industry needs and academic research. The result of this close relationship is industry-led high-impact research, which results in many IEEE publications as well as other affiliate technology publication platforms. The centre provides an open innovation and collaborative research model, with transparent IP rules, that builds trust among our academic and industry partners.

For academic partners, MCCI provides core research funding and support for funding proposals as well as access to state-of-the-art circuit design infrastructure, CAD tools, design methodologies. A diverse industry membership gives us access to application knowledge across the value chain that individual members would not have.

In 2023, the importance of semiconductors and secure regional supply chains became a very important economic realisation. Semiconductors are a key enabler to the future growth of the global economies. Recent geo-political tensions and situations across the globe have increased the importance of having a geographically balanced secure supply of semiconductors available. The introduction of the various Chips Acts into law and significant government funding across all global territories has given a renewed focus on semiconductors and the importance of research and development and supply chains. MCCI is therefore in a very strong position to play its part in helping Ireland grow and strengthen its position in the semiconductor sector within a European context.

Donal Sullivan

Chairman MCCI Central Steering Committee (CSC)



Executive Director's Message

Executive Director's Message

It is with great pleasure that I present to you the 2023 Annual Report of the Microelectronic Circuits Centre of Ireland (MCCI). This year successful activity has been a testament to our collective efforts, vision, and unwavering commitment to excellence in microelectronic IC design research. Our dynamic approach to innovation and collaboration continues to propel us forward as we strive to be a globally recognized leader in our field.

Vision and Mission

Our vision to lead globally in microelectronic IC design research is driven by our commitment to creating impactful research that advances technology and meets the immediate needs of the industry based in Ireland and abroad. This ensures our work remains both relevant and transformative and has real economic impact, especially with the advent of the EU and US Chips Acts coming into law during 2023 and the significant EU funding being made available to the EU Chips JU in order to strengthen Europe's strategic position in semiconductors by 2030. Our mission continues to focus on delivering world-class IC design technology innovation through industry collaboration, making a real impact and offering benefits for societal good, the environment and the planet in general.

Significant Achievements in 2023

In 2023, we strengthened our partnerships with leading semiconductor companies and expanded our network to include a diverse array of technology development companies. This growth signifies the trust and recognition MCCI has earned within the global microelectronics community. Our collaborations with many of our semiconductor member companies based in Ireland, e.g. Equal1, LumaVison, ADI, Qualcomm, Infineon, AMD, Qorvo and Cadence plus many others have opened new avenues for innovation and application-focused research. Our researchers have achieved significant milestones, including ground breaking work in analog and mixed-signal circuits, RF and mmWave technologies, and quantum control. These advancements, published in top-tier journals, are making tangible impacts in the industry.

Strategic Objectives for Phase 3 period.

As we continue to drive our Phase 3 funding period, with one eye on developing Phase 4 plans from mid-2025-2030, we are continuously looking to broaden our research scope and scale. Our key objectives for this current phase include:

- Broadening our research strategy in areas of differentiated strength and aligning with industry needs.
- Scaling up our research teams and the number of industry transfers as an output.
- Increasing the relevance and quality of our research.
- Scaling up our research infrastructure, i.e. Design Labs, CAD tools and increasing foundry technologies options in CMOS.
- Executing on EI funded DTIF partnerships and other Industry Driven research programs with SMEs.
- Making our research IP more accessible to start-ups and SMEs, fostering a more inclusive and dynamic innovation ecosystem.

Dedicated Team and Talent Development

Central to our success is our dedicated and talented research team across many Institutes in Ireland, with our critical mass at Tyndall National Institute, University College Dublin and other small groups. The growth of our alumni network, with over 120 industry transfers and 70% finding employment in Ireland, underscores the effectiveness of our training programs and our contribution to the local economy. Our researchers are not only advancing technology but also becoming leaders in the semiconductor industry.

Focus Areas for 2024

Our focus areas of research for the coming year include the needs for future networks, medical and biomedical devices and technologies, Industrial and smart IoT, and low power advanced signal processing and power management. These areas are aligned with

global technology trends and are critical for addressing emerging challenges and opportunities. We are excited about the potential of these research initiatives to drive innovation and create significant societal and economic benefits.

Looking Forward

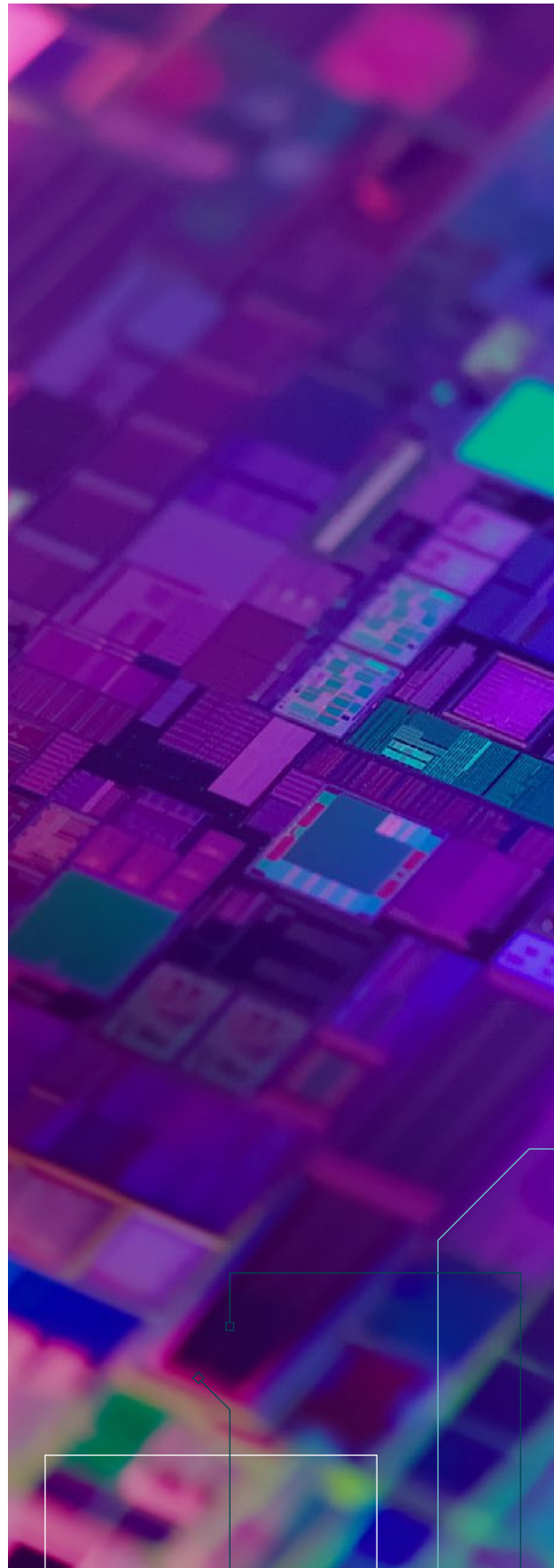
We extend our heartfelt thanks to our dedicated research team, operations staff, industry partners, academic collaborators, funding agencies, and all stakeholders. Your contributions and collaboration are the cornerstone of our success. Together, we are not only advancing microelectronics technology but also fostering economic growth and societal benefits in the longer term.

Looking ahead, we are filled with great optimism, ambition and excitement for what the future holds. MCCI is poised to continue its trajectory of excellence and scale, driving innovation, and making significant strides in microelectronics research. We invite you all to join us on this journey as we shape the future of microelectronics together.

Thank you for your continued support.



John Morrissey
Executive Director,
Microelectronic Circuits Centre of
Ireland (MCCI)



About Us

Our vision is to be a globally recognised leader in microelectronic IC design research and to build a research centre of international prominence.

What sets us apart is our emphasis on Industry-Academic collaboration, ensuring our research is not only globally competitive but also immediately impactful. MCCI has established strong partnerships with semiconductor companies such as ADI, AMD, Qualcomm, Infineon, Qorvo, and Cadence and many others. Expanding upon this vision, we seek to extend our impact to application-focused technology development companies in sectors such as biotech, med-tech, energy and power management, and smart agriculture. Collaborating with companies like, Altratech, BCON Medical, Luma Vision, Equal1, Mindseed, and Boston Scientific we are broadening our scope and diversifying our technological pursuits, thereby enhancing our overall impact and relevance.

Our aim is to achieve cutting-edge technology innovation through collaborative industry partnerships that deliver tangible benefits for society and the environment. Additionally, we strive to cultivate the next generation of semiconductor industry leaders.

Our strategic objectives revolve around research excellence in microelectronics, industry relevance, talent development, and technology transfer, all aligned with our mission statement.

As the technology industry evolves rapidly, our growth objectives include broadening research strategy in areas of strength, enhancing industry alignment, improving research quality through successful Trier 1 publishing, and increasing the scale and relevance of our work. We also aim to expand industry transfers and improve accessibility to our research IP.

Our Mission

Our mission is to produce impactful research outcomes while fostering the development of independent thinkers and future leaders in Irish companies and the global semiconductor sector.

Our research teams are distributed across six universities in Ireland: Tyndall National Institute, University College Dublin, Munster Technological University, SETU Carlow, University of Limerick and Maynooth University. Collaborating closely with our industry partners, they work on research for technological advancements to fuel the growth of the semiconductor sector.

We are a leading technology hub specialising in high-impact microelectronic IC design research for the semiconductor industry. Funded by a combination of core support from Enterprise Ireland and contributions from industry partners, MCCI operates within Tyndall National Institute in Cork, Ireland. Our strategic location within Tyndall enables seamless integration with the ICT technology research ecosystem and collaboration with diverse research groups specialising in magnetics, photonics, nano materials and quantum innovations. This leads to impactful applications, such as medical/ biomedical technology, implantable Industrial IoT, and power management/energy solutions. Partnering with global semiconductor companies, both in Ireland and abroad, we enhance microelectronic research to drive product innovations and multi-application developments. Our research focuses on analog, analog mixed-signal, RF, and millimeter-wave circuit IC architecture and design, culminating in system-level solution research demonstrators or prototypes.

A key metric of our success is the transition of PhD students and researchers to semiconductor companies in Ireland upon completing their studies. We aim to nurture talent to become leading microelectronic IC design engineers and industry technology leaders. Our collaborative approach with industry and academic partners facilitates industry-led, high-impact research, resulting in numerous IEEE publications and technology platforms. We provide state-of-the-art design infrastructure, CAD tools, and design methodologies to our academic partners, complemented by access to advanced foundry wafer fabrication and package assembly technology.

A recent addition to our research capabilities is the Cryogenic lab at Tyndall, enabling circuit testing and measurement at temperatures as low as 4 degrees Kelvin, fostering new Cryogenic-CMOS research activities in circuit design.

MCCI benefits from a technical steering advisor panel comprised of esteemed professors, researchers, and industry technologists who offer strategic guidance and direction. Their insights contribute to the development of world-leading technology research roadmaps for MCCI.

Our research outcomes and intellectual property support the creation of new startups and SMEs across various technology sectors, including wireless communications, Industrial 5.0, biomedical devices, implantable devices, and IoT applications for industry, home, and agriculture.

Our research teams are based across six of Ireland's universities; Tyndall National Institute, University College Dublin, Munster Technological University, SETU Carlow, University of Limerick and Maynooth University and they work with many industry partners on technological advances for the growth of the semiconductor sector.



Key Highlights of 2023

Mikhail Gaidukov Wins ADI Outstanding IC Student Designer Award

Mikhail Gaidukov, PhD student with MCCI won the Analog Devices (ADI) Outstanding Student IC Designer Award for 2023 for his research on time-based Analog Front Ends (AFE's). The award is presented by ADI to coincide with IEEE International Solid-State Circuits Conference (ISSCC). The ADI award has been recognising research excellence in system-level integrated circuit design in analog, mixed-signal, or digital design, since 1997 and is a great achievement for Mikhail.

Mikhail's research is focused on VCO (Voltage-controlled oscillator) based ADC (Analog-to-Digital converter). The AFE measures the information signal from the sensor and performs preliminary signal processing. In complex systems, where it is necessary to individually process signals from several sensors, it is common to implement an analog front end for each sensor. New advanced technologies are aimed at reducing the linear dimensions and power consumption of the integrated circuit while maintaining the required characteristic values. One of the advanced architectures of constructing AFEs is to use time domain signal processing. Time-based AFEs achieve lower area, lower power and high precision AFEs in advanced CMOS technologies.

Along with high resolution and low power consumption, there are several challenges. The first is the temperature sensitivity of VCO, and the second is the PWM nature of phase-to-frequency conversion. As part of the research, he is exploring methods to address and eliminate these challenges.



▲ L to r Mikhail Gaidukov, Philip Quinlan ADI, John Morrissey & Dr. Danny O'Hare MCCI



Dr. Arlene John becomes 100th MCCI Employee To Transfer To Industry

Upon completing her PhD at University College Dublin, Dr. Arlene John secured a position as an ML Mathematics Engineer with ASML Holland. Her transition to industry is a significant milestone for MCCI, as she becomes the 100th individual to move from the centre, a key metric of its success. Dr. John was supervised by Asst. Profs. Barry Cardiff and Deepu John.

◀ Dr. Arlene John



▲ John Morrissey presenting at MASC

MCCI Attend National Manufacturing & Supply Chain Conference in Dublin

MCCI attended the Manufacturing & Supply Chain Conference & Exhibition in May 2023 in collaboration with our colleagues from all of the Enterprise Ireland Technology Centres. The conference was a fantastic opportunity to connect with all the Technology Centre teams and gain insights into the market-focused research they offer. It was a collaborative effort between Enterprise Ireland and IDA Ireland, enabling Irish companies and multinationals to engage in strategic R&D projects tailored to market needs in partnership with research institutions.

MCCI Host MTC 2023

The centre was delighted to welcome our industry and academic partners to our research technical conference in June. It was the first in person MTC since Covid and there was a great buzz on the day. MTC is an annual conference where members are given early access to all of MCCI's research projects and students. The agenda was jam-packed with presentations from the team across four sessions:

13 papers were presented by the research team during the four sessions

- Sensors Interfaces and Cryo CMOS
- Low Noise and RF Freq Generation
- RF & Power Management
- Electro-Chemical Sensors and Biomedical Architecture Innovations



IEEE Solid-State Circuits Society Distinguished Lectures Series

In the summer of 2023, MCCI revived the IEEE Solid-State Circuits Society Distinguished Lectures Series (DSL) under the leadership of John Morrissey as chair for the IEEE SSCS (UK & Ireland chapter), with Dr. Daniel O'Hare serving as treasurer and Mr. Stefano Facchin from Qualcomm as Secretary of the Chapter's activities. The primary aim of these lectures is to foster interaction between industry and academia by inviting esteemed DL Speakers to Ireland, to enhance MCCI's standing as a dynamic centre in Microelectronics.



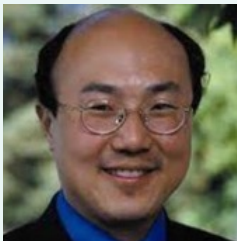
▲ Prof. Bram Nauta "Transceiver Roadmap for 2035 and Beyond" July 23rd 2023



▲ Prof. Mike Flynn "Analog Compute Engine with Multi-Level Cell ReRAM" Aug 4th 2023



▲ Prof. Robert Henderson Lecture on "Biomedical and Scientific Imaging with CMOS SPAD Sensors". Dec 4th 2023



◀ Prof. Tom Lee From "Rocks to Chips: Stories of The Transistor"
Dec 12th 2013and Beyond" July 23rd 2023

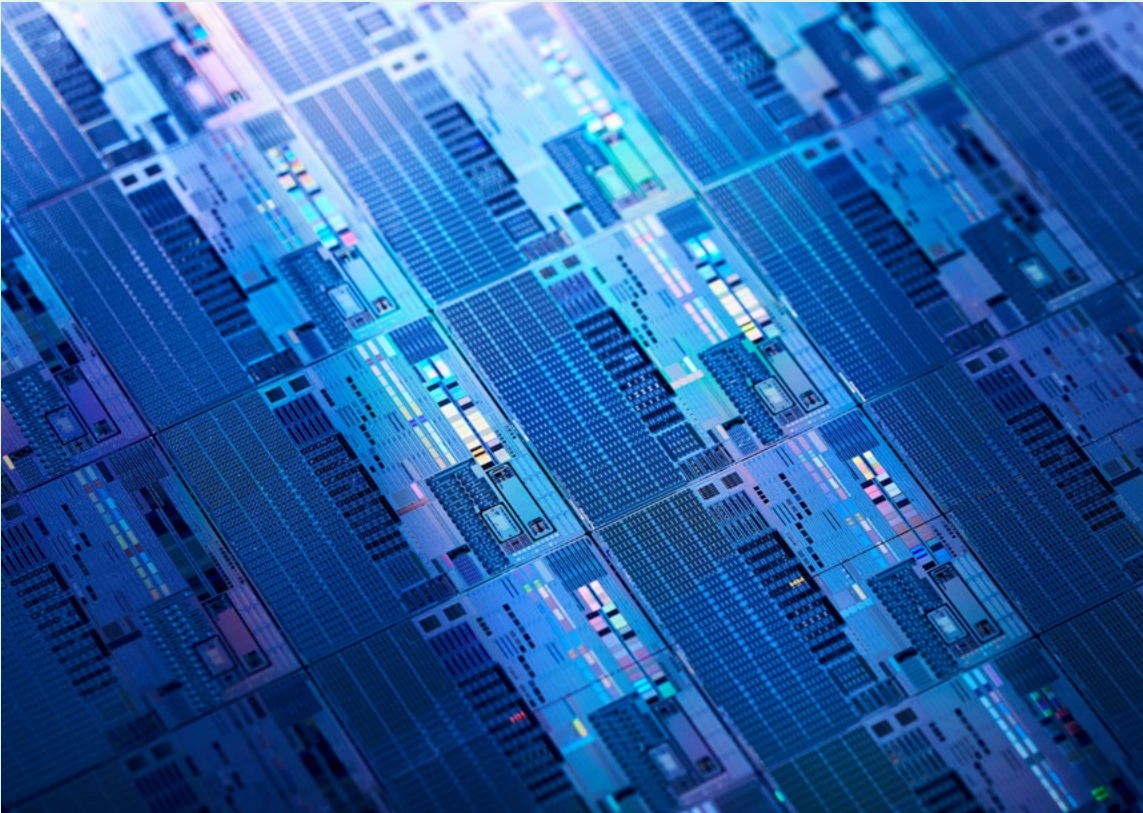
MCCI Secured Funding For Industry Research Equipment in Enterprise Ireland Funding Call

MCCI was one of the 48 third-level industry projects that collectively secured €16.5m in government funding to purchase equipment for research, development and innovation (RD&I) as part of the 2023 Capital Equipment Fund.

The funding will give MCCI's member companies access to both established and leading-edge equipment hosted by Technology Gateways and Technology Centres across Ireland. MCCI, who are hosted at the Tyndall National Institute, is proud to be part of the Technology Centre Programme, a joint initiative between Enterprise Ireland

and IDA Ireland. The technology Centres programme is resourced by highly qualified researchers who provide a unique ecosystem for collaboration in strategically important areas.

This significant investment by Enterprise Ireland in MCCI will enhance our laboratory measurement capabilities for applications that are of strategic importance to our industry partners. It will enable MCCI to build further on our Cryo CMOS for Quantum computing research pillar which is currently a very much in demand research topic for industry.



Research Pillars



Research Pillars



Broadband & Low Power RF Transceivers

Our RF & mm wave research is focused on for next generation low power broadband , data-centres and cloud computing. RF for next generation wireless 5/6G communications, medical, environmental sensing, imaging and stimulation.



Power Management

This strategy is focused on Ultra Low Power (ULP) and higher efficiency PMIC integrated systems, and energy harvesting solutions. Research is exploring highly integrated power supplies systems to address the need for smaller physical form factors and energy reduction while achieving higher energy efficiency challenges.



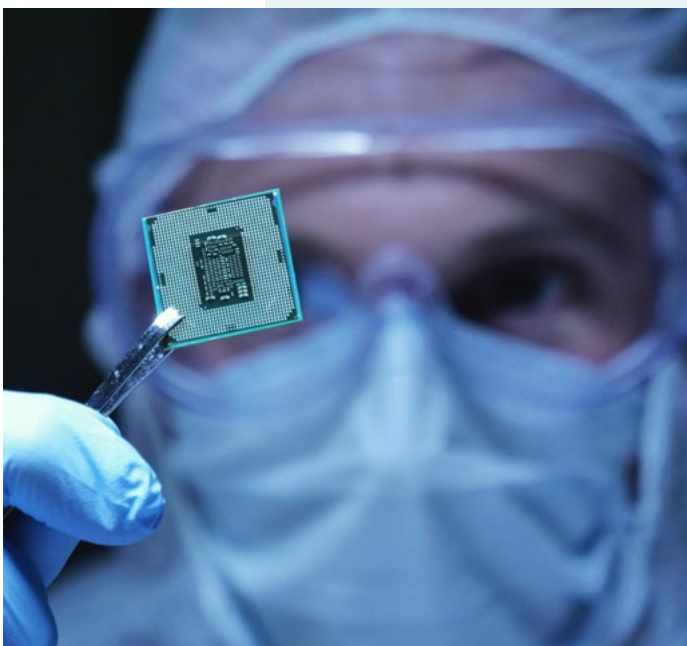
RF & mm wave

RF in this area research is focused on applications of microwave and millimetre wave RF front-end components, RF co-design methods for multi-functional RF components, filter synthesis techniques, broadband antenna arrays and low-cost integration methods for wireless, space and defence communication systems.



Precision Analog Circuits

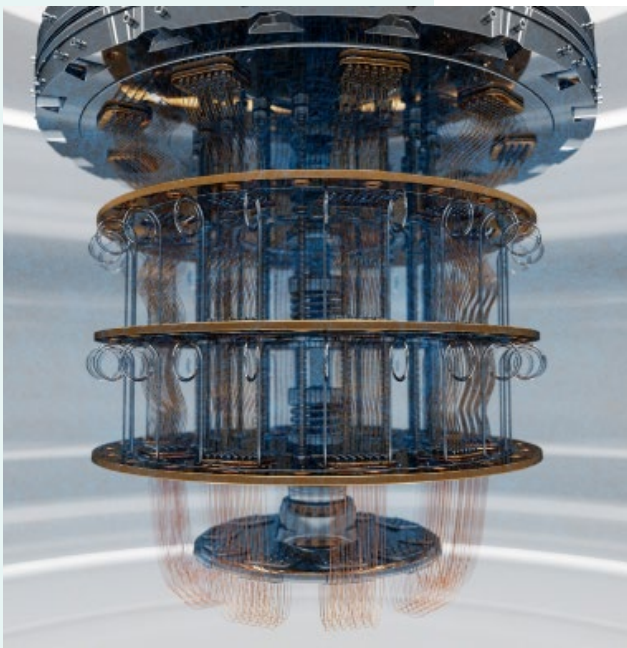
Our Precision Analog Circuits research explores ultra-low power high dynamic range data converters, multi-sensor interfaces, analogue front ends for ultra-low power applications in Industrial 4.0 and Biomedical/Medical devices including implantables.





The Intelligent Edge & Digital

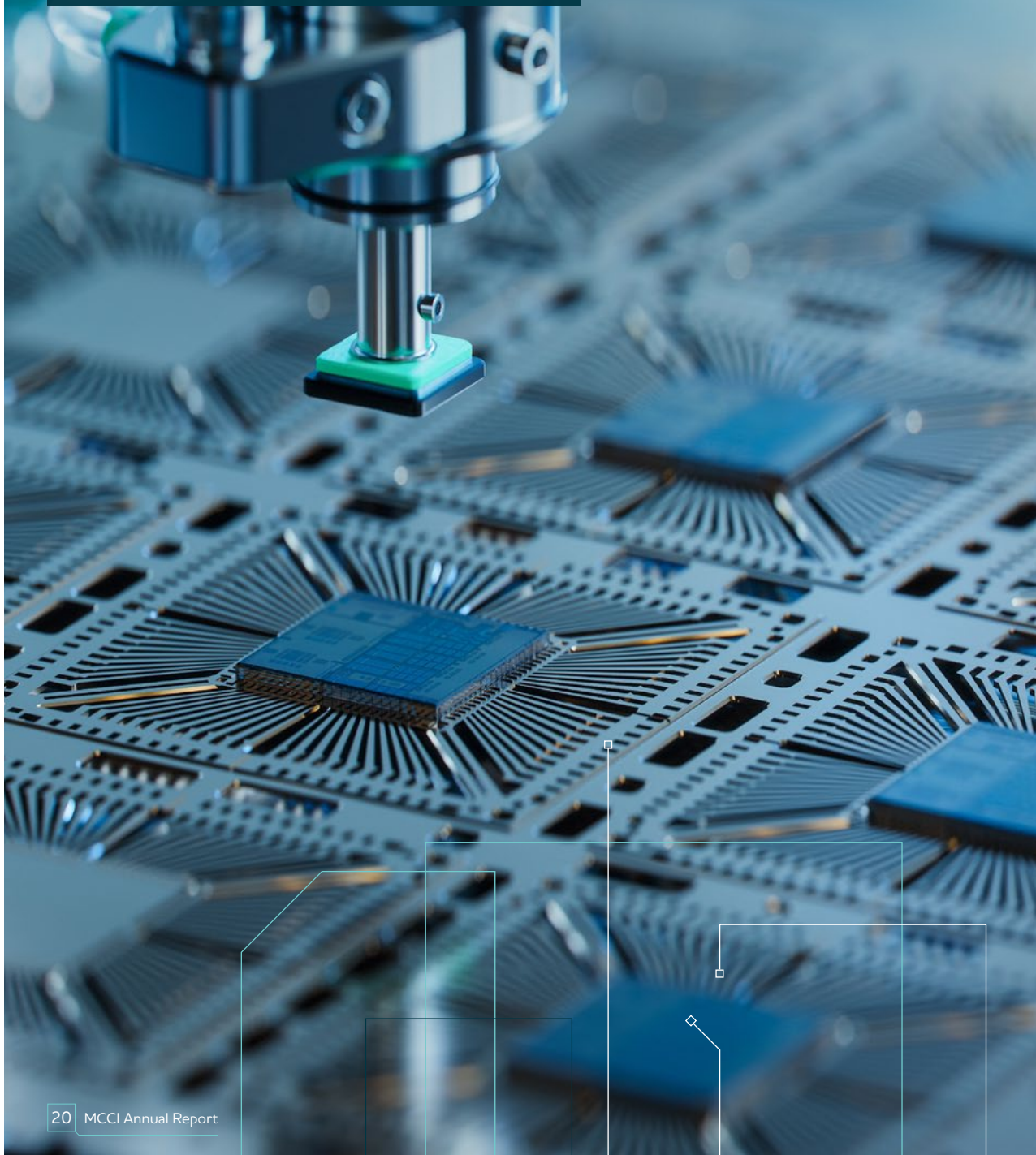
We are exploring new lower power efficient circuit architectures for data sensing, measurement & data conversion to digital and stored incorporating Machine learning (ML) and AI. Data Security is a growing concern globally and research investigations into how circuit design partitioning can help achieve a more secure data network.



Cryogenic CMOS

A new research pillar, Cryogenic CMOS will examine and develop CMOS circuit designs that operate effectively at ultralow temperatures, i.e. down to 4 degree Kelvin. Part of the research is investigating how PCB testing materials and spice level models for circuit design behave at these temperatures and verify new methods and techniques for improved performance.

Application Areas





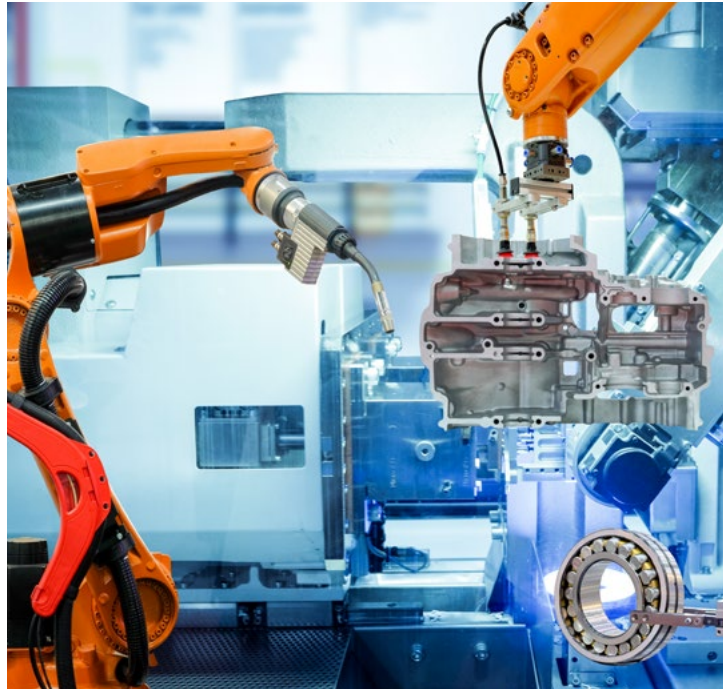
BioMedical & Medtech



Power Management & Energy



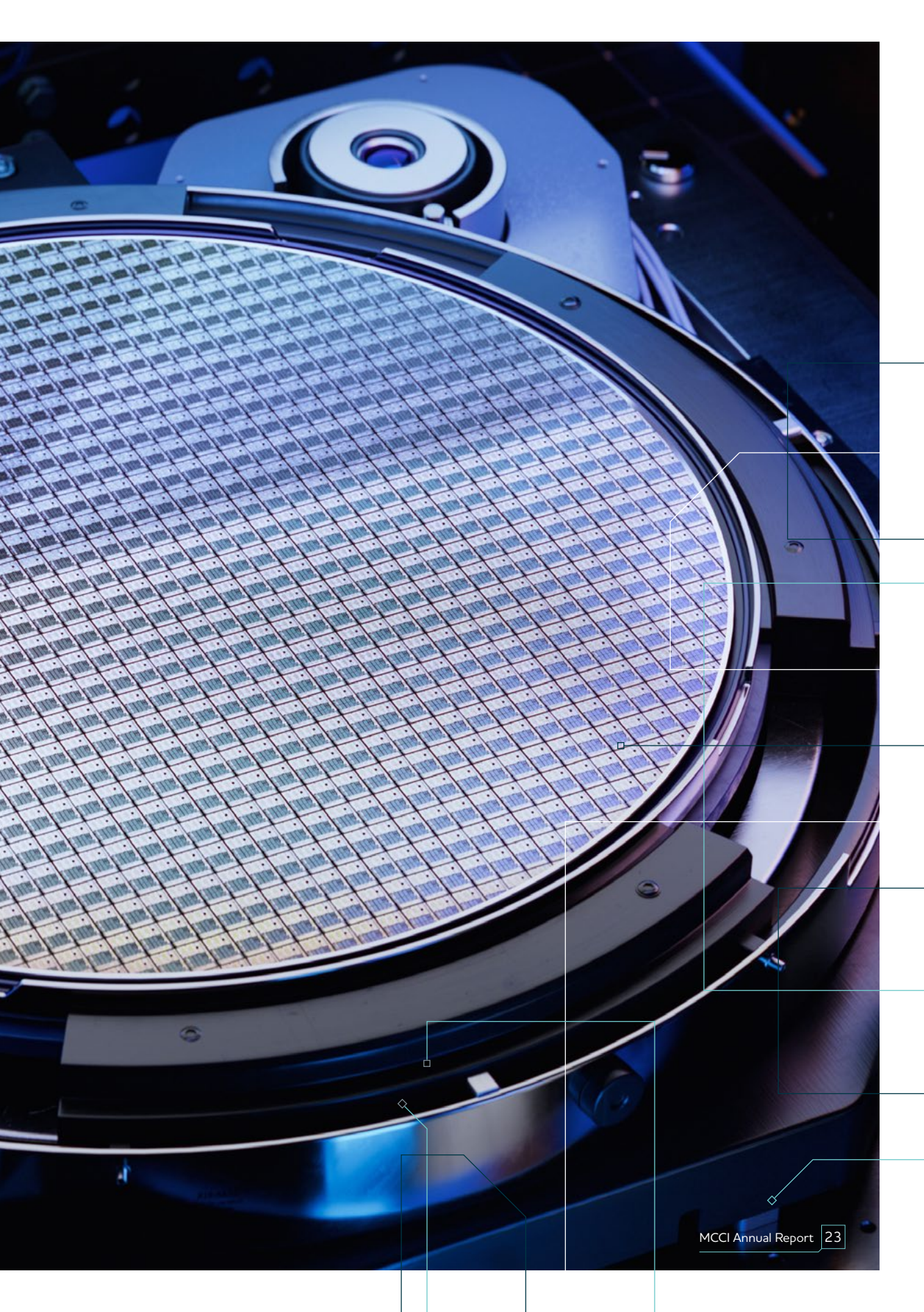
Wireless Communications



Industrial, Instrumentation & IOT

MCCI Industry Members





Researcher Profiles



Research Leaders



Dr. Danny O'Hare



Prof. Dimitra Psychogiou



Dr. Gerardo Salgado



Prof. Peter Kennedy



Dr. John Buckley



Prof. Anding Zhu



Prof. R. Bogdan Staszewski



Dr. Elena Blokhina



Dr. Teerachot Siriburanon



Mr. Seamus O'Driscoll



Dr. Deepu John



Dr. Barry Cardiff



Dr. Pádraig Cantillon-Murphy



Dr. Darren Francis Kavanagh



Dr. Brendan Mullane

MCCI Team in Tyndall National Institute

- Prof. Pádraig Cantillon-Murphy, Principle Investigator (BioMedical Imaging)
- Dr. John Buckley, Principle Investigator (RF Wireless Antenna & Systems)
- Dr. Daniel O'Hare, Principle Investigator (Sensor Interfaces & Precision Circuits)
- Prof. Dimitra Psychogiou, Principle Investigator (RF & mm wave)
- Mr Seamus O'Driscoll, PI of Power Management (ULP PMIC)
- Dr. Gerardo Salgado, Senior Researcher
- Subhash Chevella Senior Researcher
- Anita Schuler, Senior Digital Design Engineer
- PhD Students:
Anthony Wall, Zhongzheng Wang, Rachel Georgel, Minda Wen, Javier Higes Marquez, Brendan O Callaghan, Alessandro Ferro, Mikhail Gaidukov, Madhu Jacob, Rahul Jaiswal, Mohammed Nasser, Nidhya Mathew Brendan O'Sullivan, Ruaidhrí Murphy, Aleksandr Sidun, Manish Srivastava, Andrija Stankovic, Madhan Venkatesh, Daniel Woodward, Zixiao Zhang, an Pavlovic, Herman Alexander Jaeger, Dr. Kilian O'Donoghue, Manish Srivastava, Nadeem Rather, Cian O Donnell

MCCI in University College Dublin

- Prof. Peter Kennedy, Principle Investigator (RF PLL/Freq Generation)
- Prof. R. Bogdan Staszewski, PI, (RF Freq Gen & RF Transceivers)
- Prof. Anding Zhu, PI, (RF & mmw Transceivers)
- Dr. Teerachot Siriburanon, PI, (RF)
- Dr. Elena Blokhina, PI, (RF & mmw Transceivers)
- Dr. Deepu John, PI, (RF & mmw Transceivers)
- Dr. Barry Cardiff, (RF & mmw Transceivers)
- PhD Students

Armia Salib, Dawei Mai, Reza Nikandish, Amir Bozorg, Yizhe Hu, Hieu Minh Nguyen, Reza Nikandish, Amir Bozorg, Dr. Panagiotis Giounanlis, Viet Anh Nguyen, Hieu Minh Nguyen, Mohamed Shehata, Jianglin Du

Brian Keogh, Samaneh Sadeghi Maraht, Chenhao Chu, Li Xiaolinn

MCCI Team in University of Limerick

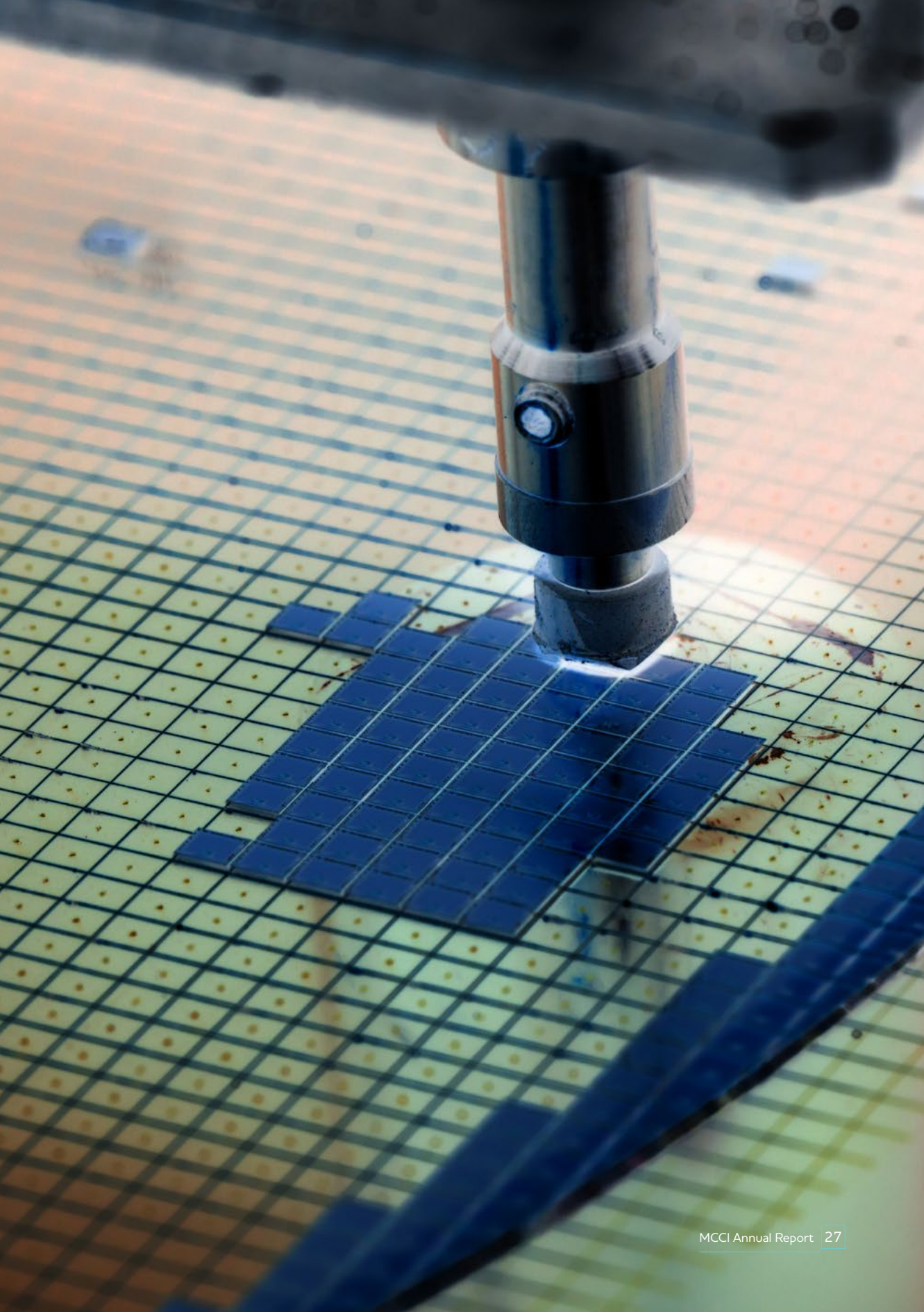
- Dr Brendan Mullane, Principle Investigator (Digital Signal Processing (DSP) and CPU)
- PhD Students Shantanu Mehta

MCCI Team in South East Technological University

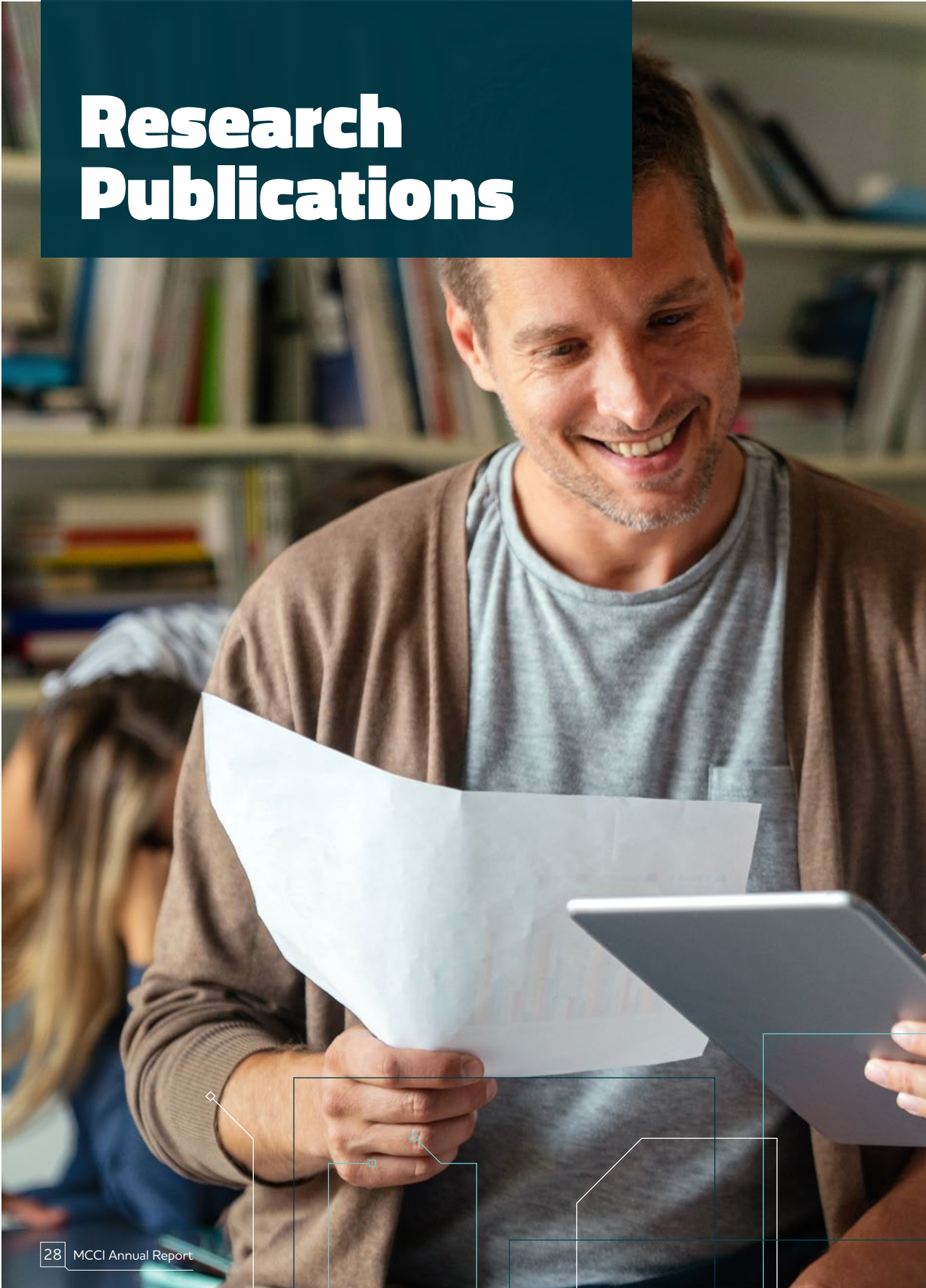
- Dr Darren Francis Kavanagh, Principle Investigator (Analog Mixed-Signal Design)
- Dr Vincent O'Brien, Principle Investigator (Analog Mixed-Signal Design)

MCCI Team in Maynooth University

- Dr. John Dooley
- PhD Students
- Johnathan Guimaraes Ribeiro



Research Publications





Tier One Publications

1. **G. Wang, Q. Wang, G. Iyer, A. Nag, D. John**, "Unsupervised Pre-Training Using Masked Autoencoders for ECG Analysis", **BioCAS**, Oct 2023
2. **M. Venkatesh, G. M. Salgado, K. McCarthy, I. O'Connell**, "A 500 kS/s 71.8 dB 5.7 fJ/Conv-step Switch Supply Based Comparator SAR ADC for Biomedical Portable Devices", **BioCAS**, Oct 2023
3. **H. Yin, A. Zhu**, "Iterative Multimetric Model Extraction for Digital Predistortion of RF Power Amplifiers Using Enhanced Quadratic SPSA", **MTT**, Sep 2023
4. **Q. Luo, A. Zhu**, "Widen Linearization Angle of Beamforming Arrays With Semi-Partitioned Digital Predistortion", **IMS** Jun 2023
5. **D. Psychogiou, K. Zhao**, "High-Q Monolithically-Integrated Bandpass Filters Using Quarter-Spherical Resonators", **IMS** Jun 2023
6. **Z. Zhang, D. Psychogiou**, "Multi-configurable Bandpass Filters with Tune-all Single-, Dual-band Transfer Functions and Reconfigurable Directionality", **IMS** Jun 2023
7. **K. Zhao, D. Psychogiou**, "Compact 3D-Printed Bandpass Filters Using Coaxial and Dual-mode Ridged-Waveguide Resonators", **IMS** Jun 2023
8. **D. Mai, M. P. Kennedy**, "Initial Condition-Dependent Spur Pattern Induced by Undithered MASH DDSM Divider Controller", **ISCAS** May 2023
9. **X. Chen, Y. Hu, T. Siriburanon, J. Du, R. B. Staszewski, A. Zhu**, "A 30-GHz Class-F Quadrature DCO Using Phase Shifts between Drain-Gate-Source for Low Flicker Phase Noise and I/Q Exactness", **JSSC**, Jan 2023.
10. **Y. Kandeel, S. O'Driscoll, C. O'Mathuna, M. Duffy**, "Optimum Phase Count in a 5.4-W Multiphase Buck Converter Based on Output Filter Component Energies", **TPEL**, Dec 2022
11. **C. Chu, J. Pang, A. Zhu**, "Broadband Sequential Load Modulated Balanced Amplifier With Extended Design Space Using Second Harmonic Manipulation", **MTT**, Dec 2022
12. **C. Chu, V. Tamrakar, ... A. Zhu**, "High-Efficiency Class-iF-1 Power Amplifier With Enhanced Linearity", **MTT**, Dec 2022
13. **R. B. Staszewski, A. Esmailiyan, H. Wang, E. Koskin, P. Giounanlis, X. Wu, A. Koziol, A. Sokolov, I. Bashir, M. Asker, D. Leipold, R. Nikandish, T. Siriburanon and E. Blokhina**, "Cryogenic Controller for Electrostatically Controlled Quantum Dots in 22-nm Quantum SoC", **OJ-SSCS**, Oct. 2022.
14. **T. Kobal, A. Zhu**, "Digital Predistortion of RF Power Amplifiers With Decomposed Vector Rotation-Based Recurrent Neural Networks", **MTT**, Oct 2022
15. **M. Saeed, O. Märtens, B. Larras, A. Frappé, D. John, B. Cardiff**, "Event-Driven ECG Classification using Functional Approximation and Chebyshev Polynomials", **BioCAS**, Oct 2022
16. **C. O'Mathúna, S. O'Driscoll**, "Heterogeneous Integration of Power Conversion using Power Supply on Chip and Power Supply in Package", **Focus Topic / Invited Lecture, EPE ECCE**, Sep 2022
17. **Bozorg A, Staszewski R B**, "A Charge-Sharing IIR Filter With Linear Interpolation and High Stopband Rejection", **JSSC**, May 2022
18. **A. Wall, P. Walsh, K. Sadeghipour, I. O'Connell, D. O'Hare**, "An Improved Linearity Ring Oscillator-Based Current-to-Digital Converter", **SSC-L**, Aug 2022
19. **X. Chen, T. Siriburanon, Z. Wang, J. Du, Y. Hu, A. Zhu, R. B. Staszewski**, "A Digital-to-Time Converter Based on Crystal Oscillator Waveform Achieving 86-fs Jitter in 22-nm FD-SOI CMOS", **RFIC**, June 2022
20. **A. Bozorg and R. B. Staszewski**, "A Charge-Rotating IIR Filter with Linear Interpolation and High Stop-Band Rejection", **JSSC**, May 2022
21. **T. Kobal, Y. Li, X. Wang, A. Zhu**, "Digital Predistortion of RF Power Amplifiers With Phase-Gated Recurrent Neural Networks", **MTT**, April 2022

22. **Mai D, Donnelly Y, Kennedy MP, Tulisi S, Breslin J, Griffin P, Connor M, Brookes S, Shelly B, Keaveney M**, "Wandering Spur Suppression in a 4.9-GHz Fractional-N Frequency Synthesizer", *JSSC*, Apr 2022
23. **X. Wang, Y. Li, A. Zhu**, "Digital Predistortion Using Extended Magnitude-Selective Affine Functions for 5G Handset Power Amplifiers With Load Mismatch", *MTT*, Mar 2022
24. **J. Pang, C. Chu, J. Wu, Z. Dai, M. Li, S. He, A. Zhu**, "Broadband GaN MMIC Doherty Power Amplifier Using Continuous-Mode Combining for 5G Sub-6 GHz Applications", *JSSC*, Feb 2022
25. **C. Chu,.... A. Zhu**, "Waveform Engineered Sequential Load Modulated Balanced Amplifier With Continuous Class-F-1 and Class-J Operation", *MTT*, Feb 2022
26. **H. M. Nguyen, J. S. Walling, A. Zhu, R. B. Staszewski**, "A mm-Wave Switched-Capacitor RFDAC", *JSSC*, Feb 2022
27. **G. Sivapalan, K. Nundy, S. Dev, B. Cardiff, D. John**, "ANNNet: A Lightweight Neural Network for ECG Anomaly Detection in IoT Edge Sensors", *TBioCAS*, Jan 2022
28. **X. Wang, Y. Li, H. Yin, C. Yu, Z. Yu, W. Hong, A. Zhu**, "Digital Predistortion of 5G Multiuser MIMO Transmitters Using Low-Dimensional Feature-Based Model Generation", *MTT*, Dec 2021
29. **Y. Li, X. Wang, A. Zhu**, "Reducing Power Consumption of Digital Predistortion for RF Power Amplifiers Using Real-Time Model Switching", *MTT*, Dec 2021
30. **M. Saeed, Q. Wang,... B. Cardiff, D. John**, "Evaluation of Level-Crossing ADCs for Event-Driven ECG Classification", *TBioCAS*, Dec 2021
31. **A. John, K. Nundy, B. Cardiff, and D. John**, "Multimodal Multiresolution Data Fusion Using Convolutional Neural Networks for IoT Wearable Sensing", *TBioCAS*, Dec 2021
32. **S. Dartizio,... L. Avallone,... M. P. Kennedy,.. S. Levantino**, "A 12.9-to-15.1GHz Digital PLL Based on a Bang-Bang Phase Detector with Adaptively Optimized Noise Shaping Achieving 107.6fs Integrated Jitter", *JSSC*, Oct 2021
33. **J. Du, T. Siriburanon, X. Chen, Y. Hu, V. Govindaraj, A. Zhu, R. B. Staszewski**, "A Millimeter-Wave ADPLL With Reference Oversampling and Third-Harmonic Extraction Featuring High FoMjitter-N", *SSC-L*, Oct 2021
34. **V. Nguyen, F. Schembari, R. B. Staszewski**, "A Deep-Subthreshold Variation-Aware 0.2-V Open-Loop VCO-Based ADC", *JSSC*, Oct 2021
35. **Li Y, Wang X, Pang J, Zhu A**, "Boosted Model Tree-Based Behavioral Modeling for Digital Predistortion of RF Power Amplifiers", *MTT*, Sep 2021
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