Research Centers

Center for Integrated Circuits and Systems

Professor Ruonan Han, Director

The Center for Integrated Circuits and Systems (CICS) at MIT, established in 1998, is an industrial consortium created to promote new research initiatives in circuits and systems design, as well as to promote a tighter technical relationship between MIT's research and relevant industry. Eight faculty members participate in the CICS: Director Ruonan Han, Hae-Seung (Harry) Lee, Anantha Chandrakasan, Song Han, David Perreault, Negar Reiskarimian, Charles Sodini, and Vivienne Sze.

CICS investigates circuits and systems for a wide range of applications, including artificial intelligence, wireless/wireline communication, sensing, security, biomedicine, power conversion, quantum information, among others.

We strongly believe in the synergistic relationship between industry and academia, especially in practical research areas of integrated circuits and systems. CICS is designed to be the conduit for such synergy.

CICS's research portfolio includes all research projects that the eight participating faculty members conduct, regardless of source(s) of funding, with a few exceptions.

Technical interaction between industry and MIT researchers occurs on both a broad and individual level. Since its inception, CICS recognized the importance of holding technical meetings to facilitate communication among MIT faculty, students, and industry. We hold two full-day technical meetings per year open to CICS faculty, students, and representatives from participating companies. Throughout each meeting, faculty and students present their research, often presenting early concepts, designs, and results that have not been published yet. The participants then offer valuable technical feedback, as well as suggestions for future research. The meeting also serves as a valuable networking event for both participants and students. Closer technical interaction between MIT researchers and industry takes place through the projects of particular interest to participating companies. Companies may invite students to give on-site presentations, or they may offer students summer employment. Additionally, companies may send visiting scholars to MIT or create a separate research contract for more focused research for their particular interest. The result is truly synergistic, and it will have a lasting impact on the field of integrated circuits and systems.

MIT/MTL Center for Graphene Devices and 2-D Systems

Professor Tomás Palacios, Director

The MIT/MTL Center for Graphene Devices and 2-D Systems (MIT-CG) brings together MIT researchers and industrial partners to advance the science and engineering of graphene and other two-dimensional (2-D) materials.

Two-dimensional materials are revolutionizing electronics, mechanical and chemical engineering, physics and many other disciplines thanks to their extreme properties. These materials are the lightest, thinnest, strongest materials we know of. At the same time that they have extremely rich electronic and chemical properties. MIT has been leading research on the science and engineering of 2-D materials for more than 40 years. Since 2011, the MIT/MTL Center for Graphene Devices and 2-D Systems (MIT-CG) has played a key role in coordinating most of the work going on at MIT on these new materials, and in bringing together MIT faculty and students, with leading companies and government agencies interested in taking these materials from a science wonder to an engineering reality.

Specifically, the Center explores advanced technologies and strategies that enable 2-D materials, devices, and systems to provide discriminating or breakthrough capabilities for a variety of system applications ranging from energy generation/storage and smart fabrics and materials to optoelectronics, RF communications, and sensing. In all these applications, the MIT-CG supports the development of the science, technology, tools, and analysis for the creation of a vision for the future of new systems enabled by 2-D materials.

Some of the many benefits of the Center's membership include complimentary attendance to meetings, industry focus days, and live webcasting of seminars related to the main research directions of the Center. Our industrial members also gain access to a resume book that connects students with potential employers, as well as access to timely white papers on key issues regarding the challenges and opportunities of these new technologies. There are also numerous opportunities to collaborate with leading researchers on projects that address some of today's challenges for these materials, devices, and systems.

The MIT Medical Electronic Device Realization Center

Professor Charles Sodini, Co-Director
Professor Thomas Heldt, Co-Director

The vision of the MIT Medical Electronic Device Realization Center (MEDRC) is to revolutionize medical diagnostics and treatments by bringing health care directly to the individual and to create enabling technology for the future information-driven healthcare system. This vision will, in turn, transform the medical electronic device industry. Specific areas that show promise are wearable or minimally invasive monitoring devices, medical imaging, portable laboratory instrumentation, and the data communication and associated analysis and reasoning algorithms.

Rapid innovation in miniaturization, mobility, and connectivity will revolutionize medical diagnostics and treatments, bringing health care directly to the individual. Continuous monitoring of physiological markers will place capability for the early detection and prevention of disease in the hands of the consumer, shifting to a paradigm of maintaining wellness rather than treating sickness. Just as the personal computer revolution has brought computation to the individual, this revolution in personalized medicine will bring the hospital lab and the physician to the home and to the site of emergency situations. From at-home cholesterol monitors that can adjust treatment plans, to cell phone-enabled blood labs, these system solutions containing state-of-the-art sensors, electronics, and computation will radically change our approach to health care. This new generation of medical systems holds the promise of delivering better quality health care while reducing medical costs.

The revolution in personalized medicine is rooted in fundamental research in microelectronics from materials to sensors, to circuit and system design. This approach has already fueled the semiconductor industry to transform society over the last four decades. It provided the key technologies to continuously increase performance while constantly lowering cost for computation, communication, and consumer electronics. The processing power of current smart phones, for example, allows for sophisticated signal processing to extract information from this sensor data. Data analytics can combine this information with other patient data and medical records to produce actionable information customized to the patient's needs. The aging population, soaring healthcare costs, and the need for improved healthcare in developing nations are the driving force for the next semiconductor industry's societal transformation, Medical Electronic Devices.

The successful realization of such a vision also demands innovations in the usability and productivity of medical devices, and new technologies and approaches to manufacturing devices. Information technology is a critical component of the intelligence that will enhance the usability of devices; real-time image and signal processing combined with intelligent computer systems will enhance the practitioners' diagnostic intuition. Our research is at the intersection of Design, Healthcare, and Information Technology innovation. We perform fundamental and applied research in the design, manufacture, and use of medical electronic devices and create enabling technology for the future information-driven healthcare system.

The MEDRC has established a partnership between microelectronics companies, medical device companies, medical professionals at Boston-area hospitals, and MIT to collaboratively achieve needed radical changes in medical device architectures, enabling continuous monitoring of physiological parameters such as cardiac vital signs, intracranial pressure, and cerebral blood flow velocity. A visiting scientist from a project's sponsoring company is present at MIT. Ultimately this individual is the champion that helps translate the technology back to the company for commercialization and provide the industrial viewpoint in the realization of the technology. MEDRC projects have the advantage of insight from the technology arena, the medical arena, and the business arena, thus significantly increasing the chances that the devices will fulfill a real and broad healthcare need as well as be profitable for companies supplying the solutions. With a new trend toward increased healthcare quality, disease prevention, and cost-effectiveness, such a comprehensive perspective is crucial.

In addition to the strong relationship with MTL, MEDRC is associated with MIT's Institute for Medical Engineering and Science (IMES) that is charged to serve as a focal point for researchers with medical interest across MIT. MEDRC has been able to create strong connections with the medical device and microelectronics industry, venture-funded startups, and the Boston medical community. With the support of MTL and IMES, MEDRC serves as the catalyst for the deployment of medical devices that will reduce the cost of healthcare in both the developed and developing world.

MIT Program on Advanced Display Technology

Professor Jeehwan Kim, Director

The MIT Program on Advanced Display Technology, launched under the Microsystems Technology Laboratories (MTL), is an interdisciplinary initiative that brings together MIT faculty, students, and industry partners to advance the frontiers of next-generation display systems. The program was established with the goal of fostering deep collaboration between academic research and industrial innovation in the rapidly evolving display field.

A core focus of the program is on future-oriented display technologies, particularly those that will define the next generation of augmented and virtual reality (AR/VR) systems. The program brings together researchers who are working across the full stack of display innovation from backplanes and light-emitting devices to color converters and advanced optics. By addressing each of these critical components, the program aims to enable compact, efficient, and high-resolution displays tailored for emerging applications.

The program began in April 2024 with an internal workshop at MIT, which served as a kick-off for building a collaborative research community around cutting-edge display technology. Since then, the program has organized two major workshops that brought together a diverse group of participants, including major technology companies including Samsung, Meta, Apple, and Google and emerging startups. These workshops created a platform for exchanging early-stage ideas, sharing technical progress, and exploring new avenues of collaboration.

A key focus of the program is to facilitate meaningful interactions between MIT researchers and industry stakeholders. Through presentations, discussions, and networking opportunities, the workshops have enabled companies to learn about ongoing research at MIT and engage with students and faculty working at the forefront of display innovation. In several cases, these interactions have led to follow-up meetings, exploratory collaborations, and sponsored research engagements.

By connecting MIT's research strengths with industry's technological needs and long-term vision, the MIT Program on Advanced Display Technology continues to grow as a hub for innovation, collaboration, and the future of display science and engineering.

The MIT AI Hardware Program

Professor Jesús del Alamo, Co-Director
Professor Aude Oliva, Co-Director

The MIT AI Hardware Program is an academia-industry initiative advancing energy-efficient computing systems for cloud and edge AI. Co-led by Jesús del Alamo and Aude Oliva, and chaired by Anantha Chandrakasan, the program connects MIT researchers with industry partners to develop AI hardware innovations across the entire computing stack—from materials and circuits to algorithms and software.

The program encompasses a wide range of topics including analog neural networks, monolithic-3D AI systems, neuromorphic computing, secure edge AI, photonic neural networks, and quantum AI. Leveraging MIT.nano, the program supports cutting-edge, use-inspired research and collaborative projects on topics such as energy-efficient analog neural accelerators, in-memory computing, and TinyML for mobile devices.

The MIT AI Hardware Program strongly values synergistic academia-industry engagement. Technical interaction is facilitated through regular in-person and virtual meetings, including a biannual Spring Symposium and Fall Research Update. Corporate members receive access to a private portal with research updates, papers, and curated seminars. Additional benefits include event invitations, recruiting opportunities, and eligibility to send visiting scientists to MIT.

Through this partnership model, the program drives impactful innovation in AI hardware and fosters meaningful collaboration between MIT researchers and leading technology companies.

Waves, Bits & Molecules Laboratory

Ahmad Bahai, Co-Director
Tomás Palacios, Co-Director
Alex Shalek, Co-Director

The Waves, Bits & Molecules Laboratory is envisioned as a world-class Health Science & Semiconductor innovation space and multidisciplinary program leveraging innovation in semiconductor technology, machine learning, biochemistry, and material science towards a future of true personalized healthcare. It provides a flexible, open-access prototyping environment where researchers and students from diverse disciplines can rapidly iterate hardware and systems spanning biosensing, signal processing, microfluidics, and edge AI.

The lab supports joint projects that blend molecular systems with digital and analog circuitry-fostering convergence at the intersection of technology, life science, and computation. To support this mission, the Waves, Bits & Molecules Laboratory has begun acquiring specialized equipment for optoacoustic imaging, magnetic sensing, microfluidic platforms, and physiological phantoms. As an incubator for early-stage translational research, the Waves, Bits & Molecules Laboratory advances MTL's mission of integrating waves (RF and optics), bits (information processing), and molecules (biological and chemical interfaces) to address critical health and technology challenges.