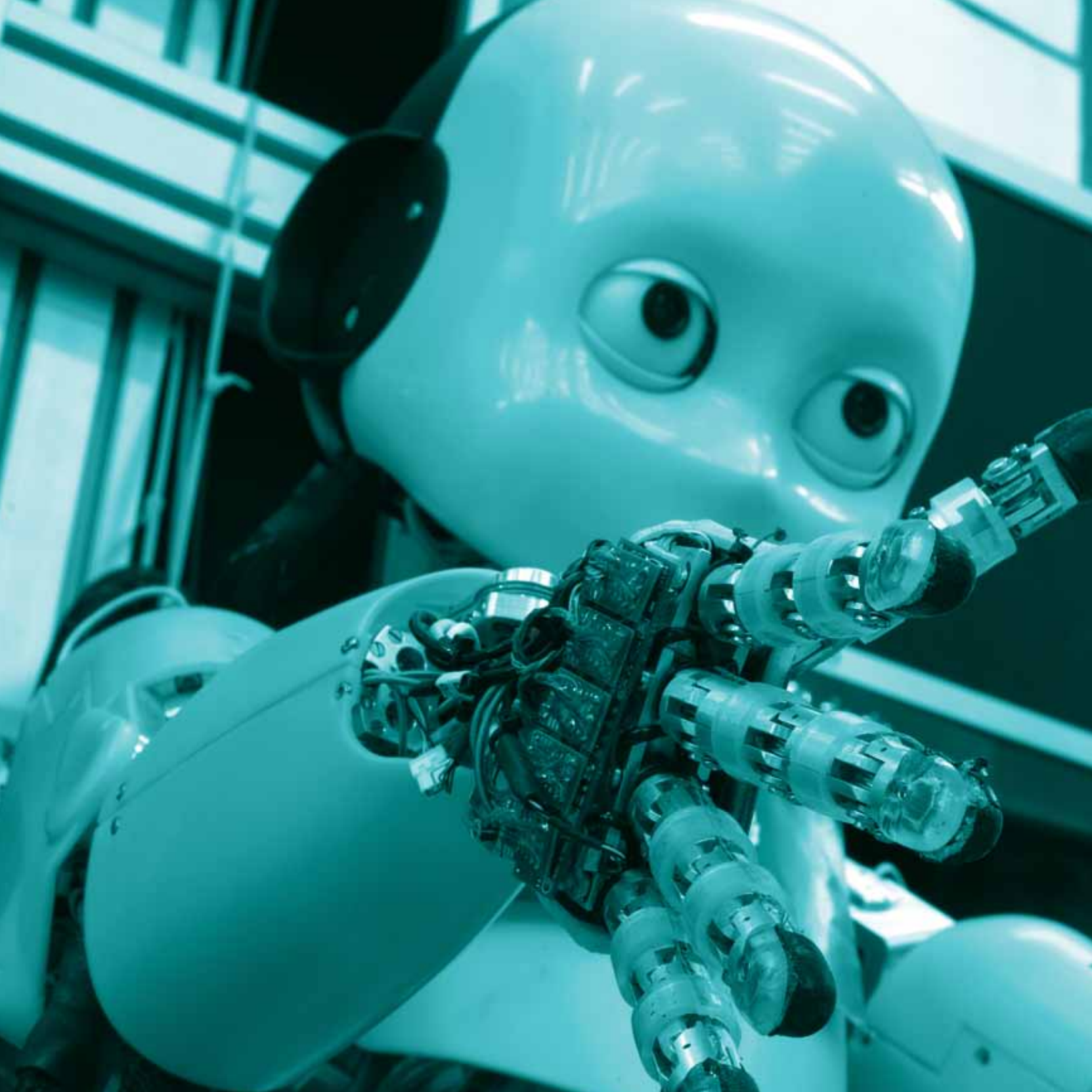
ODTÜ RESEARCH FOR INDUSTRY

HORIZON 2020

h2020.metu.edu.tr

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY



Prof. Dr. Nesrin HASIRCI

“TRUST INTELLIGENT BIOMATERIALS FOR A HEALTHIER, HAPPIER AND LONGER LIFE.”

Biomaterials and Tissue Engineering Applications

Prof. Dr. Nesrin Hasırcı is a member of the Chemistry Department of ODTÜ. She is an expert on biomaterials and tissue engineering applications of polymers and composites, the use of nano- and microtechnology for the preparation and modification of materials, and surface-tissue interactions. Her work covers the synthesis and preparation of polymers and hydrogels for medical applications, micro- and nanosystems for controlled and targeted drug delivery, new formulations for bone cements, polymeric systems for enzyme immobilizations, dental and bone supporting materials, skin substitutes and wound covering systems.

Dr. Hasırcı is one of the founders of the Graduate Department of Biomedical Engineering, the Head of the Graduate Department of Biotechnology and the Assistant Director of the Center of Excellence in Biomaterials and Tissue Engineering (BIOMATEN).

Her years of experience in research not only at ODTÜ but also at the Massachusetts Institute of Technology, Department of Chemical Engineering, (Cambridge, USA); is reflected in the more than 150 SCI journal papers, 5 chapters in scientific books, and 1 edited book published, 40 M.Sc. and 20 Ph.D. theses supervised, and numerous manuscripts and projects reviewed for various national and international scientific journals and funding programmes. The best proof of her success is the fact that she has been able to transfer her knowledge in the field of biomaterials, synthesis and modification of surface or bulk properties to the solution of specific medical problems and receive 3 patents showing the novelty of her contributions.

The first patent application of Dr. Hasırcı was to the “Turkish Patent Institute” and was titled “Gelatin sponge structures used in medical applications and the process of production of these structures.” This patent was approved as an ‘Examined Patent’ in 2006. It is about a polymeric biocompatible and biodegradable system containing bioactive agents designed to treat wounds with healing difficulties, experienced in cases such as diabetes or pressure ulcers. The polymeric product fills the wound area, the bioactive agents trigger cell proliferation, and as the tissue grows the material degrades and is absorbed by the body without leaving any material behind. Today, it has become a medical product and has taken its place in the service of the patients.

Dr. Erol ŞAHİN

“ROBOTS CAN USE THE NOTION OF AFFORDANCES WITH THE VERY SAME LEARNING SYSTEM TO COMMUNICATE WITH HUMANS.”

Field of Research: Swarm Robotics and Cognitive Robotics

Prominent Project: “Emergence of Communication in Robots through Sensorimotor and Social Interaction” - ROSSI

Funding Scheme: FP7 – ICT

Project Coordinator from ODTÜ: Dr. Erol ŞAHİN

Project Budget : 2,800,000.00 EUR

Dr. Şahin received his PhD in Cognitive and Neural Systems from Boston University in 2000, after getting his BS and MS in Electrical and Electronics Engineering from Bilkent University, and Computer Engineering from ODTÜ in 1991 and 1995 respectively. He joined Starlab Research Laboratories, Belgium, as a Chief Scientist in 2000 before moving to IRIDIA of Universite Libre de Bruxelles, Belgium in 2001. At IRIDIA, Dr. Şahin worked as a post-doctoral researcher for the Swarm-bots.

Dr. Şahin assumed his faculty position at the Department of Computer Engineering of ODTÜ in 2002. He founded the KOVAN Research Lab., which hosts 3 faculty members and 9 graduate students at the moment. Dr. Şahin has received more than 1,500,000 Euro of funding from EU and The Scientific and Technological Research Council of Turkey (TÜBİTAK). Specifically, he successfully completed two StREP projects within FP6 and FP7, two TUBITAK projects, and one industrial project. In particular, he received a free iCub humanoid platform from the RobotCub consortium, after his proposal was ranked 6th among 31 proposals received worldwide. Recently, he received the prestigious Marie Curie International Outgoing Fellowship to work on robot manipulation at the Robotics Institute of Carnegie Mellon University, USA.

Dr. Şahin’s research has focused on Cognitive and Swarm Robotics. In Swarm Robotics, he has defined the field through a highly cited position paper, and publishing of edited books and special issues on the topic as early as 2004. He has outlined the challenges in swarm robotics and the early results on developing behaviors for a swarm robotic system in the Swarm-bots project using artificial evolution. He has developed the first truly self-organized flocking behavior in a group of mobile robots and has shown how they can be guided externally.

In Cognitive Robotics, he has focused on using the notion of affordances, conceived in Psychology. He formalized this notion to be used at different levels of autonomous robot control ranging from perceptual learning, to planning and language. Specifically, using the framework of affordance formalization, he developed methods that enabled robots to learn and use affordances; i.e. the action possibilities offered to it by the environment. Dr. Şahin has shown that the learning of these affordances allowed the robot to make predictions about the effects of its actions, and that it can make multi-step plans to achieve complex manipulation tasks on the iCub humanoid robot platform. Recently he has shown that the robot can ground concepts represented by nouns, adjectives and verbs into its own sensorimotor experiences as represented through affordances.

Besides publishing in major conferences and journals, Dr. Şahin has edited three journal special issues, two conference proceedings, two books (one published by Springer in its State-of-the-Art series as the “first book on swarm robotics”). He served as the Area Chair on Multi-Robots track for AAMAS’09 and as a Program Chair for ANTS’2010, EpiRob’2010 and ICDL/EpiRob’2014 conferences. He is serving as an Associate Editor for the Adaptive Behavior journal since 2008 and as Editorial Board member of the Swarm Intelligence journal since 2007.

Prof. Dr. Levent TOPPARE

“A NEW INDUSTRIALLY VIABLE METHOD FOR THE PRODUCTION OF POLYCARBYNES, POLYMERIC PRECURSORS TO DIAMOND AND DIAMOND LIKE CERAMICS”

Synthesis and Characterization of Conducting Polymers

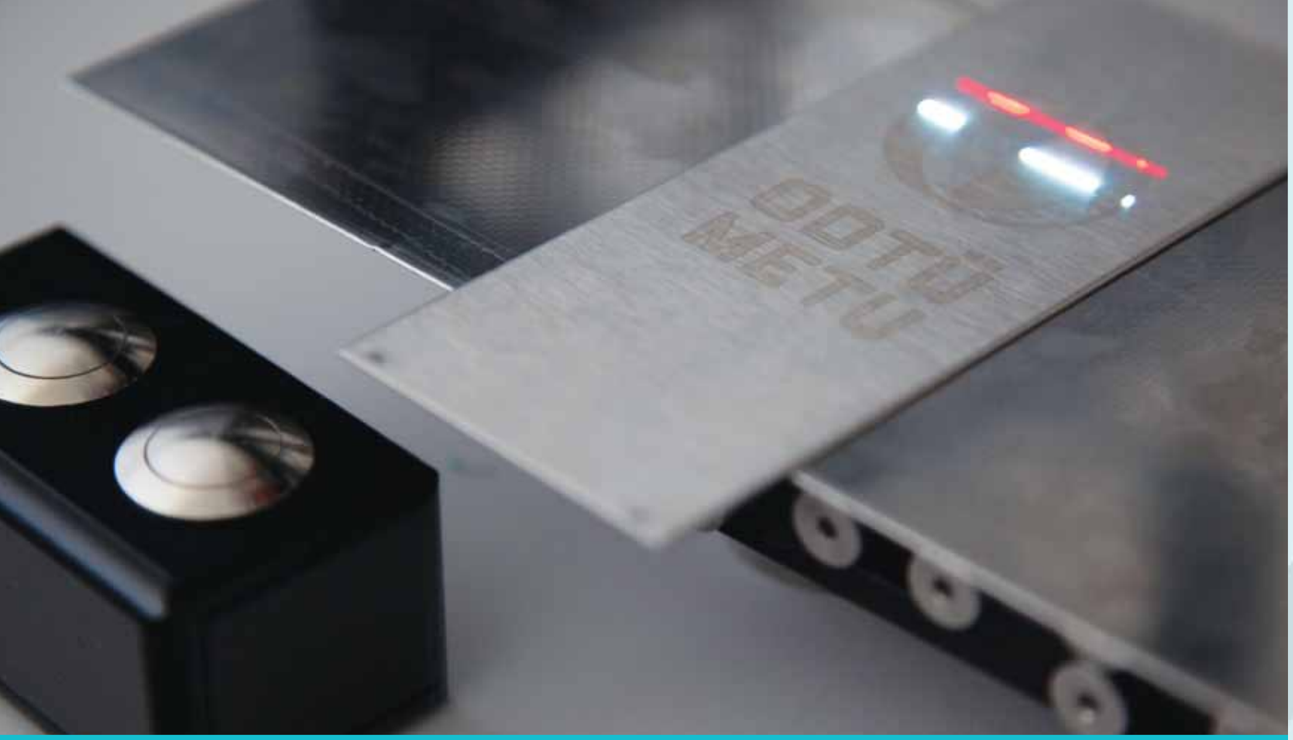
The main research areas of Prof. Dr. Toppare, a member of the Department of Chemistry at ODTÜ, are the synthesis and characterization of conducting polymers towards applications such as organic photovoltaics, organic light emitting diodes, biosensors, electrochromic devices and polymeric precursors to diamond and diamond like ceramics.

A long standing challenge in the area of electrochromic polymers, synthesis of a neutral state green polymer with a transmissive oxidized state, was addressed for the first time in his laboratories. This research resulted in numerous papers in prominent journals and also patented in Turkey. Later, his research resulted in the synthesis of a benzotriazole-containing polymer that can switch between all primary colors, black and transmissive upon applied potential, which is one of the most significant achievements in the area of electrochromic materials.
The invention was patented in US as benzotriazole containing donor-acceptor type polymer as a multipurpose material.

Prof. Dr. Toppare’s research also focuses on photovoltaic devices. He is the director of a fully equipped solar cell research facility under GÜNAM, ODTÜ and his group is actively working in all major areas of photovoltaic research; from design and synthesis of polymers to device fabrication and characterization.

Organic light emitting diodes constitutes another major area in Toppare Research Group. The main aim of the group is the development of efficient and stable polymeric materials towards realization of polymer light emitting diodes as alternative display technology.

A unique collaboration between Prof. Toppare and Dr. Michael Pitcher at ODTÜ, in 2006 resulted in an unexpected and novel way of producing diamond and diamond-like ceramics. What started as a one-off experiment in 2006, has now led up to multiple papers being published, citations garnered and patents being granted. The patent describes the invention of a very simple way to make polymers called the polycarbynes. This simple synthesis only involves an organic precursor, some batteries and salt.
The polymer produced from this synthesis is the only polymeric precursor to synthetic diamond and the conversion occurs simply heating the material to 600-1000 °C under inert atmosphere. The synthetic diamond market was in 2011 estimated around 6 billion carats (1.2 billion grams, 6 billion US $). Recent calculations have shown that with this patented synthetic procedure, synthetic diamond can be produced in much cheaper manner than those of other producers.



ODTÜ-MEMS (Micro-Electro-Mechanical Systems Research and Application Centre)

Developing a wide-variety of microsensors and components, including low-cost CMOS infrared detectors, accelerometers, gyroscopes, DNA analysis systems, biosensors, micro power generators, chip cooling systems, acoustic sensors, humidity sensors, temperature sensors, frost sensors, piezoresistive and capacitive pressure sensors, and various RF MEMS components.

Director: Prof. Dr. Tayfun AKIN **www.mems.metu.edu.tr**

"CURRENT GOAL OF ODTÜ-MEMS CENTRE IS TO BE A CENTRE OF EXCELLENCE IN THE FIELD OF MEMS, SERVING NATIONAL AND INTERNATIONAL RESEARCH AND TECHNOLOGY FOR INDUSTRIAL DEVELOPMENT."

MEMS activities at ODTÜ have started in 1995 within the Electrical and Electronics Engineering Department, and since then, a number of research projects have been conducted that are supported by various national and international institutions, including TÜBİTAK, State Planning Organization (DPT), Ministry of National Defense R&D (MSB), Civil Defense Industry (SSM), European Union 6th and 7th Framework Programmes, NATO SfS Programme, NSF, TOFAŞ, and Intel.

As a result, a considerable amount of knowledge and experience has been gained, and the first MEMS centre was established in Turkey in 2008, which is called ODTÜ-MEMS Centre. In ODTÜ-MEMS Centre, a wide-variety of microsensors and components has been and is being developed, including low-cost CMOS infrared detectors, accelerometers, gyroscopes, DNA analysis systems, biosensors, micro power generators, chip cooling systems, acoustic sensors, humidity sensors, temperature sensors, frost sensors, piezoresistive and capacitive pressure sensors, and various RF MEMS components. Some of the developed prototypes show compatible performances to the best examples in the world, and efforts to commercialize these microsensors and microsystems currently continuing.

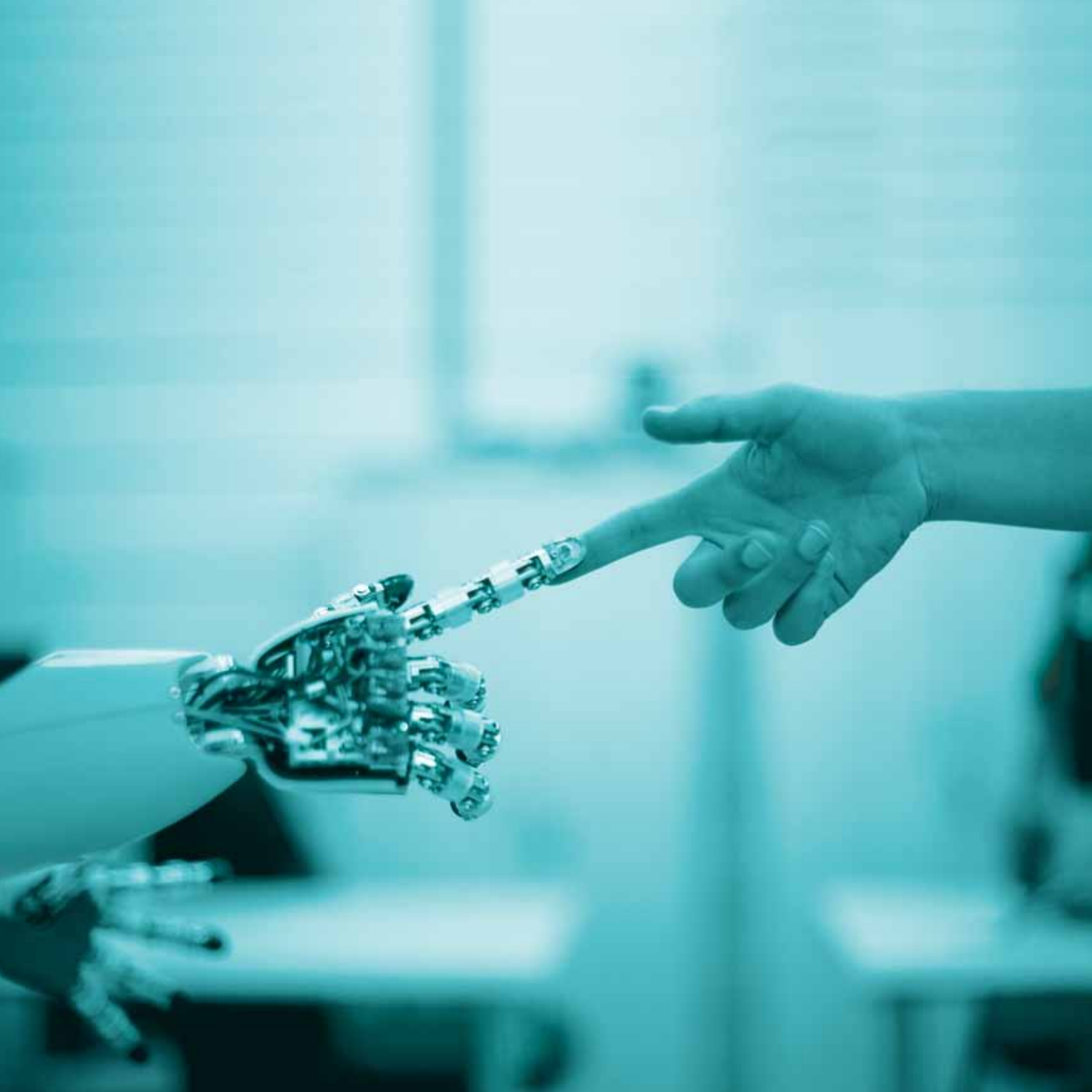
In the past 15 years, ODTÜ-MEMS Centre has collaborated with a number of national/international partners, such as IMEC (one of the largest microelectronics/MEMS centre in Europe), Intel, University of Michigan at Ann Arbor, Arizona State University, Massachusetts Institute of Technology, ASELSAN, TOFAŞ, and ARÇELİK (also known as BEKO).

With the help of these collaborations and the success of the projects, ODTÜ-MEMS Centre gained a well-deserved recognition both in national and international arenas. Based on this good reputation, the IEEE/ASME MEMS 2006 conference, which is the most prestigious international conference in the field, was held in İstanbul, Turkey, being the 4th country in Europe (after Germany, The Netherlands, and Switzerland) that could organize this conference.

Centre was awarded by the EU 7th Framework Programme (EU-FP7) Regional Potentials (REGPOT) Project (METU-MEMS) in December 2009 with the largest budget ever, for a Turkish Participant Institution. The project ended with a Brokerage Event on the MEMS and Microsystems Technologies on 26-27 November 2013 at the Cultural and Convention Centre of ODTÜ, Ankara, Turkey.

As of 2014 there are 8 faculty members, 5 post-doctoral research fellows, more than 40 M.Sc. and Ph.D. students, and 26 technical personnel working at the Centre.

ODTÜ-MEMS Centre has a microelectronics fabrication facility for 4", 6" and partially 8" wafer processing with a 1000 sq. meters of class 100 and class 1000 clean room area for fabrication and 300 sq. meters of class 10000 clean room area for electrical testing of IC's and active discrete components. The centre possesses installed specialized utilities to maintain the ultra-clean environment required to manufacture MEMS devices and support its equipment. The process equipment include a stepper with a 0.35/m resolution, automatic photo resist coaters, DRIE, RIE, ICP RIE, PECVD, LPCVD, a contact aligner with wafer bonders, oxidation and diffusion furnaces, a vacuum probe station for wafer level probe testing, and a number of metrology equipment.



ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

Üniversiteler Mahallesi, Dumlupınar Bulvarı No: 1
06800 Çankaya Ankara / TÜRKİYE
T: +90 312 210 2000 F: +90 312 210 1105

www.metu.edu.tr