IEEE Electron Devices Society Distinguished Lecturer

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Free Form Electronics: Expanding the Horizon of Electronic Applications

Muhammad Mustafa Hussain
IEEE Electron Devices Society Distinguished Lecturer
Associate Professor, Electrical Engineering
Computer Electrical Mathematical Science and Engineering Division
King Abdullah University of Science and Technology (KAUST)
http://nanotechnology.kaust.edu.sa
E-mail: muhammadmustafa.hussain@kaust.edu.sa

Abstract:
Infotainment and entertainment are two major areas where Complementary Metal Oxide Semiconductor (CMOS) electronics have made major contributions. Moving forward we expect to see their dominance in automotive applications. At the same time, we are seeing increased interest in the area of Internet of Things (IoT) to connect trillions of sensors. We are preparing for Internet of Everything (IoE) applications where people, process, data and devices are going to be connected through new generation of electronics which are not possible today. Therefore, our research is focused on hybrid integration of heterogeneous materials, processes and devices to build free form (flexible, stretchable, reconfigurable in shape and size) interactive and high-performance electronics and systems for smart living and a sustainable future focusing on healthcare, water, food and environment. For scientific exploration, we develop integration strategy to make collective use of the materials, processes and device architecture leveraging multidisciplinary tracks of electrical engineering, material science, bioengineering, computer science and engineering, mechanical engineering, environmental engineering (focusing plants and marine science) and health science. As engineering tool, we use CMOS technology extensively due to its industrial relevance, maturity and reliability for rapid tech transfer. In my talk, I will discuss the advances we have made to make tomorrow’s applications available today. Specifically I will be using some examples which are commercially relevant and/or under commercialization: (i) healthcare devices focusing on pain management and brain machine interface; (ii) 3D printed smart objects with embedded electronics; (iii) plug and play smart wearable platforms with integrated sensors and actuators and (iv) physically reconfigurable shape systems.

Bio: Dr. Muhammad Mustafa Hussain (PhD, ECE, UT Austin, Dec 2005) before joining KAUST was Program Manager of Emerging Technology Program in SEMATECH, Austin. His program was funded by DARPA NEMS, CERA and STEEP programs. A regular panelist of US NSF grants reviewing committees, Dr. Hussain is the Editor-in-Chief of Applied Nanoscience (Springer), Editor of IEEE Transactions on Electron Devices and an IEEE Senior Member. He has served as first or corresponding author in 75% of his 227 research papers (including 16 cover articles and 92 journal papers in Nano Lett., ACS Nano, Adv. Mater., Adv. Funct. Mater., Small, Nat. Asia Mater. Appl. Phys. Lett., IEEE Trans. Elect. Dev. etc.). He has 41 issued and pending US patents. His students are serving as faculty and researcher in KFUPM, UC Berkeley, TSMC, KACST and DOW Chemicals. Scientific American has listed his research as one of the Top 10 World Changing Ideas of 2014. He has received 25 research awards including this year’s Outstanding Young Texas Exes Award 2015 (UT Austin Alumni Award), US National Academies’ Arab-American Frontiers of Sensors 2015, DOW Chemical Sustainability Challenge Award 2012, etc.