**Beyond Traditional Electronics: Innovations in Topology and Functionality**

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Abstract:

The convergence of functionality and topology in electronic materials is poised to revolutionize smart and sustainable devices. By seamlessly integrating sensing, storage, computation, and actuation within unconventional material and device geometries, we can unlock transformative advancements. This paradigm shift promises significant improvements across multiple fronts, including lower power consumption, faster response times, reduced fabrication costs, and a minimized material footprint—all contributing to a more sustainable future for electronics. This talk will explore three compelling examples of this exciting trend: 1) smart memory devices that can sense, store, and compute; 2) 4D printed actuators that can sense and perform actuation; and 3) octopus-inspired biopatches that can sense and achieve adhesion. Specifically, we will discuss how these novel devices leverage unique material properties and innovative fabrication techniques to achieve multifunctional capabilities, showcasing their potential to revolutionize fields from energy and robotics to healthcare, AI, and sustainable electronics.

**Nazek El-Atab** is an Assistant Professor of Electrical and Computer Engineering and the Principal investigator of the Smart, Advanced Memory devices and Applications lab (SAMA) at King Abdullah University of Science and Technology (KAUST), Saudi Arabia. Prof. El-Atab's research interest focuses on the design and fabrication of smart multifunctional devices and their applications, including in-memory sensing and computing, 4D-printed devices, among others.

Prof. El-Atab has received several awards for her research, including the 2015 For Women in Science Middle East Fellowship by L'Oreal-UNESCO, the 2017 International Rising Talents Award by L'Oreal-UNESCO, and was portrayed in the 2019 "Remarkable Women in Technology" by UNESCO. Prof. El-Atab was also selected to participate in the 70th Lindau Nobel Laureate Meeting in Germany, was selected among the 2020 UC Berkeley EECS Rising Stars, among the 10 Innovators under 35 by MIT Technology Review Arabia in 2020, as a "NEOM Changemaker" in 2021, and as a V60 Women in Sustainability by Boston Consulting Group. She has been listed among the 2023 "Rising Stars" by the Advanced Materials journal (Wiley) and among the 2024 "Emerging Leaders" by the Journal of Physics D: Applied Physics (IOP). She has published over 100 papers in international peer-reviewed scientific journals and conference proceedings, 2 book chapters, 2 books and 10 filed U.S. patents. She is an IEEE Electron Devices Society Distinguished Lecturer. She served on the technical program committees for a number of prestigious conferences including Device Research Conference, IEEE Electron Devices Technology and Manufacturing and IEEE International Flexible Electronics Technology Conference. She is an Associate Editor of IEEE TED, IEEE EDS Magazine, Nano Select and Microelectronic Engineering.