

Tutorial #2

Empowering CMOS-VLSI by MEMS Technology - An Example of High-Voltage Photovoltaic Chiplet Integration for Autonomous Micro Robotic Systems

Yoshio Mita
University of Tokyo, Japan

Abstract— Taking full advantage of combining the Academic VLSI foundry system and open nanotechnology nanofab platform both available through VDEC/d.lab in Japan, a “MEMS-empowered agile CMOS-VLSI” research has been conducted since 15 years. Highly-reliable VLSI is made through multi-chip foundry, then the LSI is post-processed to introduce additional functionality. A clear demonstration example is a series-connected silicon photovoltaic chip. Our PV chip directly generates 60V and its voltage can be defined by a mask design. It is impossible to obtain such a high voltage by the material itself - bandgap of silicon is 1.1eV so a single PV cell never generates over 1.1V. The authors are exploring to go beyond the natural limit of material through VLSI circuit and MEMS post-process technology. The method and an application of High-V PV in a tiny autonomous micro robotic system will be presented in the tutorial.

Biography



Dr. Yoshio MITA is a professor of the Department of Electrical and Electronics Engineering, the University of Tokyo. Since 2003, Pr. Mita is leading an Open Nanotechnology Platform at UTokyo Takeda Sentanch Cleanroom. He got his Bachelor, Master, and Ph.D degrees of Electrical Engineering from the University of Tokyo in 1995, 1997 and 2000, respectively. After his PhD, he served as an assistant professor of VLSI Design and Education Center (VDEC), and was promoted to Lecturer in 2001, to Associate Professor in 2005, and to Professor in 2022 all at the Department of Electrical Engineering. His current research interests include VLSI integrated MEMS, Autonomous MEMS powering devices, nanostructure and nano electrical devices by MEMS semiconductor technology. In June 2013 Dr. Mita was prized "Best Teaching Award" by Faculty of Engineering of U.Tokyo for his lecture of Electro-Informatic Systems. Dr Mita has served General Chair for IEEE ICMTS in 2019, and for Transducers 2021. He is a senior member of IEEE and IEEJ, and a member of JSAP, IEICE, and JIEP.