



Characterization and Tolerance of Ageing in Integrated Voltage Regulators

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Prof. Saibal Mukhopadhyay received his PhD in electrical and computer engineering from Purdue University, West Lafayette, IN. He is currently a Joseph M. Pettit Professor in the School of Electrical and Computer Engineering at the Georgia Institute of Technology. His research interests include design of energy-efficient, intelligent, and secure systems. His research explores a cross-cutting approach to design spanning algorithm, architecture, circuits, and emerging technologies. Dr. Mukhopadhyay was a recipient of the Intel Outstanding Research Award, 2019, Office of Naval Research Young Investigator Award in 2012, the National Science Foundation CAREER Award in 2011, and the IBM Faculty Partnership Award in 2009 and 2010. He has received multiple best paper awards in IEEE Journals and IEEE/ACM conferences. He has authored or co-authored over 350 papers in refereed journals and conferences. Dr. Mukhopadhyay is a *Fellow* of IEEE.

ABSTRACT

The on-chip integrated voltage regulators (IVRs) including inductive buck and digital low dropout (DLDO) are widely used in modern SoCs. The integration of VRs on the same chip as the digital processors reduces power supply noise, enables fast dynamic voltage/frequency scaling, and allows fine-grain point-of-load regulation. However, the controller and power stages of IVRs along with on-chip/on-package passives (inductors and capacitors) experience ageing due to effects such as Bias Temperature Instability (BTI), Hot Carrier Injection (HCI), Time-Dependent Dielectric Breakdown (TDDB), and Electromigration (EM), to name a few. This talk will discuss the impact of Negative BTI (NBTI) and HCI on the performance and efficiency of IVRs. First, the talk will present measurement results from 130nm and 65nm test-chips discussing the effect of NBTI on inductive buck and DLDO. Second, the talk will present a simulation study of the impact of HCI on the inductive buck regulator. The talk will conclude summarizing the future work on this project.

Friday, September 23, 2022 at 1:00 – 2:00 p.m.
Osborne Conference Room (ECSS 3.503)