

Integrated Systems

Exploring Ways to Maximize Efficiency and Performance in Low-Dropout (LDO) Regulators

Dr. Hyun-Sik Kim
Associate Professor, KAIST

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Zoom Meeting Link: <https://usc.zoom.us/j/92995535728>

Refreshments will be served

Abstract: Low-dropout (LDO) regulators are ideal off- and on-chip solutions for powering noise-sensitive loads due to their ripple-less output. LDOs also have many benefits over switch-mode dc-dc converters, such as rapid transient response, excellent power supply rejection (PSR), and compact footprint. Unfortunately, they suffer from an inescapable disadvantage: poor power efficiency; this is primarily caused by a considerable dropout voltage (VDO). Reducing VDO to improve efficiency often leads to a significant drop in LDO's regulation performance. Because of this, most LDOs are designed with a large VDO, making them perceived as energy-consuming components of power management systems. This talk will delve into effective ways to extremely minimize the dropout voltage without compromising performance, aiming for energy-efficient LDO regulators. We will begin with a thorough investigation of operational principles, analyses, and strategies, exploring trade-offs among key performance metrics. Next, several promising approaches to realizing energy-efficient LDO regulators will be investigated, including traditional digital LDOs, a dual-rail analog/digital-hybrid LDO, a triode-region LDO, and a voltage/current-hybrid (VIH) LDO. Finally, the technical merits and flaws of each high-efficiency LDO topology will be investigated by comparing them. In this talk, I will also share my insights from my experience developing the VIH LDO regulator that achieves 98.6% efficiency and a -75dB PSR at 30kHz.

Biography:



Hyun-Sik Kim is currently an Associate Professor of Electrical Engineering at the Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea. He received his B.S. degree (Hons.) in electronic engineering from Hanyang University, Seoul, South Korea, in 2009, and his M.S. and Ph.D. degrees in electrical engineering from KAIST, in 2011 and 2014, respectively. His research interests include the CMOS analog-integrated circuit designs, with an emphasis on display drivers, power managements, and sensory readout chips. Prof. Kim was a recipient of two Gold Prizes in the 18th and 19th Samsung Human-Tech Paper Awards in 2012 and 2013, respectively, the IEEE SSCS Pre-Doctoral Achievement Award in 2014, the IEEE SSCS Seoul Chapter Best Student JSSC Paper Award in 2014, and the KAIST Technology Innovation Award in 2022. He served as a Guest Editor for the IEEE SOLID-STATE CIRCUITS LETTERS (SSC-L) and was a member of the Technical Program Committee (TPC) for the IEEE Asian Solid-State Circuits Conference (A-SSCC) from 2016 to 2023. He is currently serving on the TPC for the IEEE International Solid-State Circuits Conference (ISSCC) and is the TPC Subcommittee Chair for the IEEE Custom Integrated Circuits Conference (CICC). He has been appointed as a Distinguished Lecturer (DL) in the IEEE Solid-State Circuits Society (SSCS) for the term 2024–2026.

Hosted by Profs. Hossein Hashemi, Mike Chen and Constantine Sideris

Organized by Soumya Mahapatra (smahapat@usc.edu)

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