DESIGN OF HIGH EFFICIENCY HYBRID SWITCHED CAPACITOR DC-DC CONVERTERS WITH FAST STARTUP

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Sponsored by: Vidatronic Egypt, Zewail City of Science and Technology***

DESCRIPTION

Fully integrated switching-mode converters (FISMC) can improve performance and reduce the power consumption of system-on-chip by providing point-of-load regulation with dynamic voltage scaling. Three topologies are always of interest when targeting FISMC; these are conventional switched-inductor converters, switched-capacitor converters, and more recently hybrid converters. The three differ in terms of maximum efficiency achieved, conversion range, silicon area, and power density. Past work has shown favorable performance of hybrid switched capacitor (SC) converters to reduce the size of needed inductor(s). However, hybrid approach has its own challenges including balancing the voltage of the flying capacitor and achieving safe and fast startup. In this project we will be designing hybrid Switched-Capacitor DC-DC converter and the controller for output voltage regulation and fast startup with a peak efficiency > 96% and self-startup time on the order of 10µs.

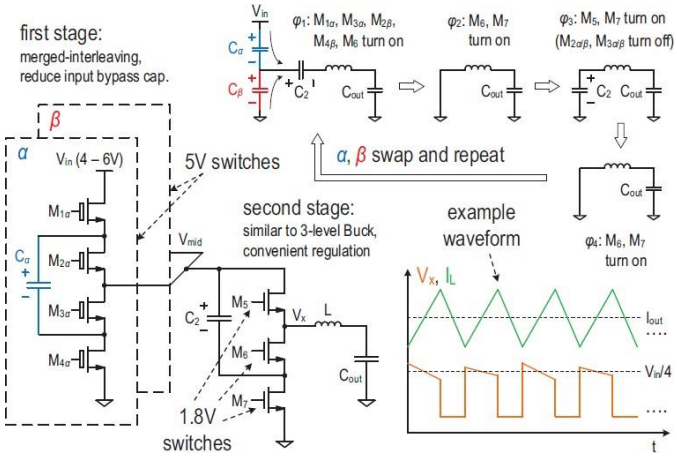

Figure 1 A Two-Stage Cascaded Hybrid Switched-Capacitor DC-DC Converter [1]

TASKS

1. Literature survey and system level simulations.
2. Circuit design of the different building blocks.
3. Layout and post-layout simulations of the different building blocks.
4. Simulation of the whole system.

TOOLS

Cadence Design System.

NUMBER OF STUDENTS

A maximum of 4 students.

REQUIRED QUALIFICATIONS

- Hard-worker, motivated and a good team member
- Circuits and systems track and electives
- Good knowledge of Circuit simulators and/or digital flow tools.

CONTACT US

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REFERENCES

[1] Z. Xia, J. Stauth, "A Two-Stage Cascaded Hybrid Switched Capacitor DC-DC Converter With 96.9% Peak Efficiency Tolerating 0.6V/µs Input Slew Rate During Startup," *ISSCC*, pp. 257-259, Feb. 2021.

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* Founded in 2010, Vidatronic is a fabless semiconductor and systems company specializing in the design of advanced-architecture, energy-efficient power management solutions for embedded and stand-alone applications.
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