Poster Session 4

Analog & RF / Digital & System

Date/Time	8/4(五) 10:30—11:30
Chair(s)	陳聿廣／國立中央大學電機工程學系

PA17

A Hysteresis-Current-Controlled Buck Converter with Current-Sensing and Phase-Locked-Loops Techniques

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This paper proposed an improved-hysteresis-current-controlled buck converter with new-type current-sensing techniques. This controlled circuit used a hysteresis-current-controlled circuit to achieve fast transient response and a new type current sensing circuit which reduced the power consumption and increased the overall system efficiency. This converter was fabricated with TSMC 0.18μm 1P6M process. The chip area is 1.12×1.18mm2, with an input voltage range of 2.7V-3.9V, an output voltage range of 0.5V-2.5V, and a load current range of 50mA-500mA. It operates at a frequency of 1.25MHz, and has transient responses of 2.7us and 2.4us, with amplitudes of 18mV and 11mV, respectively. The maximum efficiency is 86.67%.

PA18

An Adaptive On-Time Buck Converter with Pseudo-DCR Current-Sensing and Phase-Frequency-Locked Techniques

Zi-Ping Zuo, Jiann-Jong Chen
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This paper presents an adaptive on-time buck converter with new current-sensing and phase-frequency-locked techniques. The proposed converter achieves a fast-transient response and a wide output voltage range. The proposed buck converter is fabricated with TSMC 0.18μm 1P6M CMOS technology, and the chip area is 1.14 mm×1.03 mm. The measured results show that the output voltage is 1.6V, the load current changes from 50mA to 500mA, and the transient response from 50mA to 500mA is 2.2s and 2.5s, respectively. When the load current is 300mA, the maximum power efficiency is 90.65%.

PA19

A Fast Transient Response DC-DC Buck Converter with Multiple Ramps PWM Control

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This paper proposed a multiple ramps generator circuit to enable a DC-DC buck converter achieve fast transient response and stable output voltage under rapid changing load. In this paper, firstly, a voltage sensing circuit is connected to the output. When the load change is detected, the slope of the sawtooth wave is changed by the capacitor charging and discharging characteristics of sawtooth oscillator. Then, the pulse-width modulation will vary according to the duty ratio. Hence, the feedback time, recovery time, and overshoot/undershoot voltage can be reduced. The proposed circuit is fabricated by 0.18μm CMOS process technology. The circuit is composed of a buck converter circuit, a voltage sensing circuit, a bandgap circuit, an error amplifier, a Type Ⅲ compensation circuit, a sawtooth generator, a pulse-width modulation circuit, a SR latch, and a dead time circuit. From the post layout simulation results, the input voltage of buck converter is 3.3V and the output voltage is 1.8V. The overshoot voltage is 14.7mV and undershoot voltage is 15mV. The recovery time are 5.5μs and 5.8μs, respectively.

PA20

A 300mV Cold Start-up Circuit Shared The Inductor with A Thermoelectric Energy Harvesting System

Xin-Hao Yu, Po-Wei Lin, Cheng-Yang Hsu, Sandeep Kumar Yadav, Zu-Jia Lo, Sheng-Yu Peng
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A cold start-up circuit for thermoelectric energy harvesting systems is presented in this paper. The proposed cold start-up circuit shares the energy harvesting inductor and load capacitor with the main boost converter, so no extra off-chip components are required, resulting in a small form factor. The start-up circuit comprises a stacked ring oscillator, a pair of low-voltage charge pumps, a low-power voltage detector, a reset switch, and two power switches. A prototyped chip for concept proving is designed and fabricated in a 0.18 um CMOS process. The measured waveforms demonstrate that the prototyped cold start-up chip can boost an input voltage of 300mV up to 1V within 950ms when the loading capacitance is 0.1 uF.

PA21

A Low Output Voltage Ripple Buck Converter with Light Load Efficiency Improvement Using a Body-Controlled Zero-Current Detector

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A Low Output Voltage Ripple Buck Converter with Light Load Efficiency Improvement Using a Body-Controlled Zero-Current Detector(ZCD) designed and implemented using the TSMC 0.18μm 1P6M process. The voltage-squared ripple control mode is adopted in this buck converter. In the traditional ripple control buck converter architecture, the detected inductor current and output voltage ripple are superimposed as feedback signals to ensure stability even when there is low output voltage ripple, thereby improving the limitations of the traditional architecture when applied to loads with low ripple requirements. Additionally, a body-controlled ZCD is used to create an offset voltage on the comparator to counteract the delay of the comparator itself, logic, and driver, and to improve light load efficiency through precise ZCD. The chip area is 1.19979mm×0.888mm, the input voltage range is 2.8V-3.3V, the output voltage range is 1.2V-2.0V, and the load current range is 50-500 milliamperes. When the output voltage is 1.5V, the transient response of switching the load current from 50 mA to 500 mA and from 500 mA to 50 mA is 5.2 μs and 5.09 μs, respectively. At a load current of 300 milliamperes, the highest efficiency is 95.78%

PA22

An Adaptive On-Time Controlled Buck Converter with New-Rds,on-Current-Sensing Techniques

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This paper introduces a new type of buck converter that utilizes new techniques for Rds,on current sensing. The proposed converter can achieve high efficiency and fast transient response times. The converter is fabricated with TSMC 0.18μm 1P6M process, and the chip area is 1.2 mm×1.19 mm. The output load current range is 50~500mA. The load transient response times are about 2.34 μs and 2.13 μs when the load currents are light to heavy and heavy to light, respectively. The maximum peak efficiency is 93.58% when the output voltage is 1.2V and the load current is 300mA.

PA23

A V^2 Adaptive On-Time Buck Converter with Transient Accelerated Circuits

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This paper proposed A V2 Adaptive On-Time (AOT)Buck Converter with Transient Accelerated Circuits，AOT Control captures input and output information to adjust the conduction period of the circuit, generating a more stable operating frequency. Transient Accelerated Circuits adjust the on-time during current load switching in the circuit, allowing the transient voltage to return to a stable state in the shortest possible time. The proposed buck converter is fabricated in TSMC 0.18um 1P6M CMOS processes with a chip area of 1.19mm × 1.088mm. The measurement results show that the transient recovery times are 1.3μs and 1.4μs, and the undershoot and overshoot voltages are 9mV and 15.3mV, when the load current changes from 50mA to 500mA and from 500mA to 50mA. The peak power efficiency is 93.86%, when the load current is 300mA and output voltage is 1.8V.

PA24

Digital IC & DSP Controller Design for Boost Converter Base on SIMPLIS-VH/SIMetrix

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In the field of power systems, initial system design is often completed using MATLAB, Simulink, PLECS, SIMPLIS & SIMetrix, while later chip design is carried out using relevant software provided by Cadence or Synopsys. However, this approach requires switching the system to different design platforms for simulation and verification, which takes additional time to rebuild the system. Therefore, this paper proposes a new design process to implement a digital boost converter using SIMPLIS & SIMetrix for both system and chip design, enabling design and verification to be completed on a single platform without the need to change the simulation platform and save time on rebuilding the system. The digital controller in this paper is implemented using TSMC 0.18um CMOS process and compared with the traditional design process using Cadence.

PD19

Rapid and High-Sensitive Admittance Sensor for Sweat Analysis

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Sweat analysis has emerged as a promising approach for detecting various diseases and monitoring health conditions.

In comparison to conventional blood tests, sweat analysis offers the advantage of non-invasiveness and low infectious risk.In this study, we have developed a sensitive and reusable electrolyte analysis device.The device utilizes electrode plates to measure the corresponding admittance of the test sample, and then amplifies the subtle signal response for observation. The designed sensor device can be applied to estimate the ion concentration of electrolytes in sweat with high sensitivity and stability, thereby enabling the detection of changes in individuals' health status.The affordability and reusability of this rapid sweat analyzing system make sweat a valuable and reliable health indicator, in line with the principles of low-cost and accessible healthcare technologies.

PD20

Design and Implementation of a Plant Electrophysiological Signal Identification Method Based on LSTM Convolutional Networks

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With an increasing number of practical applications, research on plant sensing has been receiving constant attention. The aim of the research is not to simply demonstrate that "plants have thoughts", but to explore why and how plants perceive their surrounding environment. Both animals and plants have been using signals that contain specific chemical substances to communicate with the outside world. Plants, for example, use chemical substances to communicate, grow, and defend themselves.

We have developed a new electrophysiological sensor that serves as an autonomous device to demonstrate plant thinking, which can transmit plant potential data transformed into plant autonomous consciousness signals. Plant sensing can measure certain aspects of the natural plant's internal state, and the sensor circuit design is based on electrophysiological methods used in electrocardiography and electroencephalography. We use plant electrophysiological methods to collect physiological data and perform data analysis to infer the plant's behavior. Among many neural networks, we have chosen the LSTM (Long Short-Term Memory) neural network

for analysis. The LSTM neurons retain memory context in their pipelines, allowing them to address sequencing and time issues without suffering from gradient vanishing problems that can affect performance. They can solve the continuous changes in physiological timing correlations in plants.

Index terms: plant sensing, plant electrophysiology, neural networks.

PD21

Distributed IoT Access Control Mechanism with Ureka

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The rapid expansion of IoT technology has resulted in significant productivity and efficiency gains for individuals and organizations. Nevertheless, current centralized access control systems present significant security and privacy risks. To address these concerns, this paper proposes a distributed self-sovereign access control mechanism for IoT that supports secure authentication and authorization with clear accountability. We present a complete solution for managing ownership in IoT, including establishing and transferring ownership. Our cryptography-based approach, utilizing the "U-ticket" and "mini-firewall," enables a secure and efficient exchange of access control messages among owners, users, and devices, resulting in a robust IoT ecosystem. Our design grants self-sovereignty to device owners, enabling them to manage their devices independently, reducing device costs, and increasing security by eliminating the need for Internet connectivity. This paper demonstrates how the U-ticket and mini-firewall method provides a comprehensive solution for device initialization, ownership management, authorization, revocation, and identity verification, while maintaining security and privacy in the IoT system.

PD22

Automated Classification of Multi-class Eye Disease with Lightweight CNN Architecture and Weighted Volume Test

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As deep learning development becomes more mature, there are a lot of models are developed toward deeper. However, we think that 3D-optical coherence tomography (OCT) eye image classification may not need a complicated model. And also, there exists a study that confirms our speculation. Therefore, we are trying to employ the simpler convolutional neural network (CNN) model on multiple eye disease classification. One is the lightweight model MobileOCT and it reaches an accuracy of 87.03%. The other is the proposed Lighten Modified A-OCT achieving an accuracy of 89.82%. Besides, we also proposed the weighted volume test to solve the problems that will meet in the realistic case.

PD23

Optimizing Real-time Bearing Remaining Useful Life Prediction through Health Stage and Dynamic Feature Selection Division based on Monotonicity

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Rotating machinery is widely used in various fields, such as wind turbines, car engines, and various machines in factories. It is evident that the maintenance strategy for rotating machinery is crucial. Therefore, predicting the remaining useful life (RUL) of machinery is beneficial in formulating suitable maintenance strategies and reducing maintenance costs. Due to unpredictable human errors and uncontrollable factors during operation, it is difficult to evaluate the RUL of machinery using simple methods. Traditional RUL prediction methods also cannot adjust the prediction model in real-time with the current status of the machinery or factory. We propose an RUL prediction method based on an artificial neural network (ANN) and an adjustment technique using root mean square (RMS) to simplify computations and improve real-time results. Finally, compared to related research methods, we were able to dynamically adjust appropriate features based on the machinery state, resulting in a reduction of errors by 95.59% to 97.76% and a decrease in the number of parameters by 96.92% to 99.36%, achieving lower computational costs.

PD24

Distributed Self-Sovereign IoT Access Control Transaction Management

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This paper proposes a user-centric solution for transaction management in the Internet of Things (IoT) by integrating blockchain smart contract technology with the Ureka IoT architecture. Traditional IoT provider-centric management systems face significant security, privacy, and dispute resolution challenges, making a shift towards self-sovereign access management systems necessary. The proposed design empowers IoT device owners and users to manage access controls and transaction data while maintaining privacy, security, and trust. One significant advantage of the proposed design is that IoT devices do not require an internet connection, reducing device costs and energy consumption. Users can use a mobile device as an intermediary for secure and trustworthy access to the target device. The proposed solution offers flexible device deployment locations, reduced device costs and energy consumption, and secure self-sovereign IoT infrastructures.

PD25

An Automatic Detection System of Multiple Eye Diseases Based on Extreme Learning Machine

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In recent years, machine learning (ML) has been combined with more and more research in the field of medicine. This research hopes to use ML to assist ophthalmologists in diagnosing eye diseases. Optical coherence tomography (OCT) images provide high-resolution images of the eyeball. Therefore, this paper attempts to use OCT images combined with ML to build an automatic detection system for eye diseases. This research uses extreme learning machine (ELM) as an ML classifier, and takes advantage of its high-speed operation and easy hardware implementation to achieve the goal. Although the current accuracy can only reach 69.09%, the prototype of the automatic eye disease detection system has been successfully built, and it is hoped that the process can be improved in the future to achieve high accuracy.