Vidya Vikas Education Trust's

Universal College of Engineering

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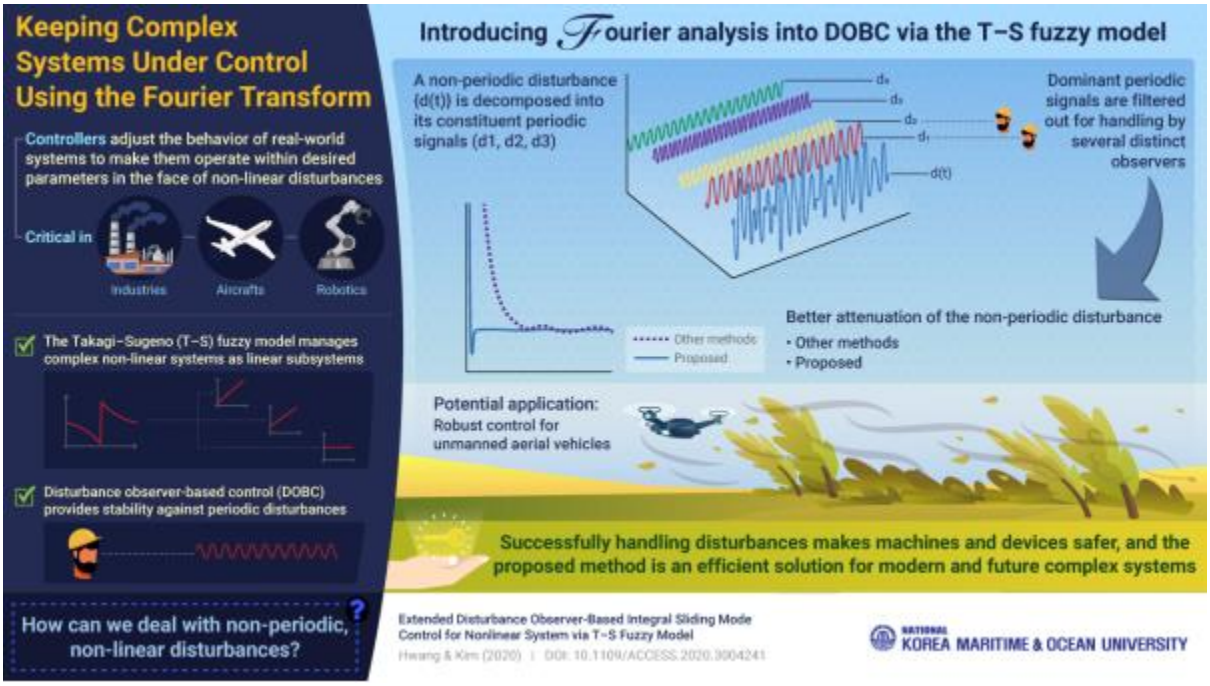
Department Vision:

To be recognized for practicing the best teaching-learning methods to create highly competent, resourceful and self-motivated young electronics engineers for benefit of society.

Department Mission:

- To nurture engineers who can serve needs of society using new and innovative techniques in electronics.
- To improve and apply knowledge of electronics subjects through participation in different technical events.
- To enhance carrier opportunities of electronic students through industry interactions and in plant training.
- To install the passion and spirit among students to pursue higher education in electronics and entrepreneurship.

Under Control: Empowering Disturbance Observer Controllers with the Fourier Transform



Scientists from the National Korea Maritime and Ocean University and Yonsei University, Korea, combine the fuzzy disturbance observer-based control theory with the Fourier transform to design a controller that can handle nonperiodic, nonlinear disturbances. This feature makes their approach suitable for dynamic real-world systems such as drones, which have to deal with nonperiodic disturbances like the wind and changes in air resistance.

As modern society progresses, and automated systems become more sophisticated and complex, the importance of designing advanced and reliable controllers skyrockets. Controllers monitor system variables and ensure that processes and machines operate stably within defined limits. Over the last two decades, controllers based on the disturbance observer-based control (DOBC) theory have become increasingly popular. These controllers measure external disturbances affecting the system and compensate them as necessary in order to keep the system stable. However, existing implementations of this theory can only manage periodic disturbances, which greatly limits their applicability—in the real world, disturbances can take many forms and are usually nonperiodic.

In a recent study published in IEEE Access, a pair of Korean scientists tackled this problem through an innovative approach: combining the DOBC theory with a powerful mathematical tool called the Fourier transform. Dr Han Sol Kim from the National Korea Maritime and Ocean University explains their reasoning: “The Fourier transform can be used to represent a nonperiodic disturbance as a sum of infinite periodic disturbances. Then, by selecting the most dominant periodic disturbances only, we can design distinct DOBCs that compensate for each one.”

To achieve this, the scientists began with the Takagi–Sugeno fuzzy model, an approach that represents complex nonlinear systems—which describe many real-world dynamic systems—as linear subsystems. By combining a slightly modified version of this fuzzy modelling method with

the DOBC theory and applying the Fourier transform, they managed to design a controller with a better response compared with other state-of-the-art methods, as shown through simulations.

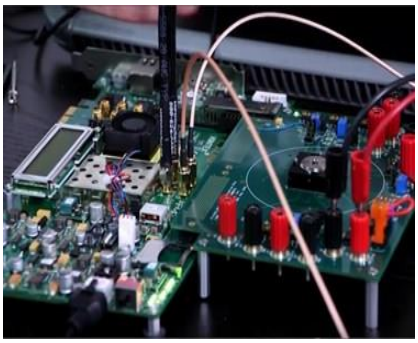
This controller design could be particularly useful for modern technological systems such as unmanned aerial vehicles (UAVs), commonly known as drones. The performance of UAVs largely depends on how well they can automatically handle external disturbances such as the wind and changes in air resistance. In this regard, Dr Kim remarks: "Without properly compensating for disturbances, UAVs can cause accidents, harming people and destroying property. I believe that our method will be an efficient solution for UAV systems because it can guarantee robust performance against disturbances."

Their approach is purely theoretical so far, but they plan on implementing it in a real hardware platform in the near future. If all goes well, we might just have a new effective method for keeping our machines under control.

Reference

Authors: Sounghwan Hwang (1) and Han Sol Kim (2)
Title of original paper: Extended Disturbance Observer-Based Integral Sliding Mode Control for Nonlinear System via T–S Fuzzy Model Journal: *IEEE Access* DOI: 10.1109/ACCESS.2020.3004241

OpenFive licenses Flex Logix's eFPGA



Flex Logix Technologies, a supplier eFPGA IP, has announced that OpenFive has licensed the EFLX eFPGA for use in a low power communications SoC, to be used in data centre and edge applications. Communications systems are a major user of FPGAs due to their flexibility and reconfigurability for customisation and real-time updating of protocols and algorithms. Flex Logix's EFLX eFPGA has been designed to allow systems to be smaller and lower power by integrating the FPGA into the application-specific integrated circuit/system-on-a-chip (ASIC/SoC) compared to the traditional method of using an external FPGA.

Commenting Geoff Tate, CEO of Flex Logix, said, "Because our eFPGA can deliver significant improvements in performance, power and reconfigurability, we are seeing more opportunities to work with a premier custom silicon solution provider such as OpenFive. Customers can benefit greatly from having RTL configurability in their ASICs."

Shafy Eltoukhy, CEO of OpenFive added, "Flex Logix's eFPGA offerings are also easy to integrate across most process nodes, enabling OpenFive to deliver domain-specific custom silicon solutions with differentiated IP that are optimised for power, performance and area."

The EFLX4K Logic IP core has 4K 4-input-equivalent-LUTs, 632 inputs and 632 outputs and is a complete eFPGA. The EFLX4K DSP IP core replaces about one-fourth of the LUTs with 40 multiplier-accumulators for DSP and artificial intelligence (AI) applications. The two EFLX4K cores can be tiled together to make larger arrays to support applications needing more LUTs as required, up to 7x7 with any mix of logic and DSP cores. The EFLX arrays are programmed using VHDL or Verilog. The EFLX Compiler takes the output of a synthesis tool such as Synopsys Synplify and does packing, placement, routing, timing and bitstream generation. The bit stream, when loaded into the array, programs it to execute the desired RTL.

Source:https://www.newelectronics.co.uk/electronics-news/openfive-licenses-flex-logixs-efpga/232870/

300mA low-noise LDO is 1 x 1 mm

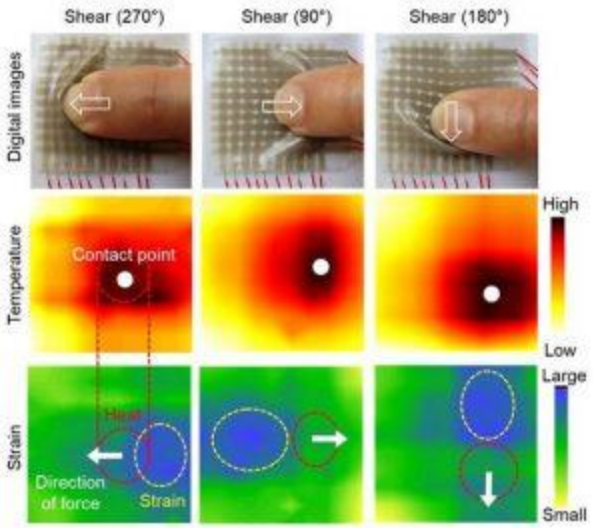
There are 32 products in the TCR3RM series, as it will be known, with single fixed outputs spanning 0.9 to 4.5V. Ripple rejection ratio is typically 100dB (1kHz, 2.8V output variant), and has a frequency characteristic optimized for post-regulating dc-dc converters. "Unlike other LDO regulators where the ripple rejection ratio usually drops 20 dB every ten-fold increase in frequency, TCR3RM falls significantly less," according to the company. "The rejection ratio at 1MHz [2.8V output] is 68dB."

Noise and ripple performance, said Toshiba, is due to the design of internal band gap circuit, low pass filter and a low-noise high-speed operational amplifier. 1µF input and output capacitors are required, which can be ceramic types. Maximum output current of is 300mA and drop-out voltage is typically 130mV outputting 2.8V at 300mA.

Quiescent current is 12µA max across the operating range of -40 to 85°C. A control pin turns the output on and off (high = on, low = off, open = off). An internal transistor automatically discharges output capacitance when the output is turned off. On stand-by, max current consumed across temperature is 1µA (100nA type 25°C). Other features include over-current protection and thermal shutdown. Applications are foreseen in portable and wearable devices, such as sensing, RF and IoT products.

Source:https://www.electronicsweekly.com/news/products/power-supplies/low-noise-ldo-1-x-1mm-2020-11/

E-skin detects both temperature and force with one sensor



To create the skin, Pohang University of Science and Technology (Postech) teamed up with Stanford University.

"Human skin is freely stretchable yet unbreakable because it is full of electrolytes, so the joint research team made the sensor using them," according to the Korean university. "They also took advantage of the fact that the ion conductor material containing electrolyte can have different measurable properties according to its measurement frequency. On the basis of the finding, a multi-functional artificial receptor was created that can measure a tactile sensation and temperature at the same time."

The skin has a simple electrode-electrolyte-electrode structure and measures temperature as well as the direction of force stimuli in complex touch like squeezing, pinching, spreading or twisting.

Measuring sensing points on the skin at two frequencies allowed two clearly separated variables to be derived:

- charge relaxation time – how long polarization of the ions takes to disappear – is dependent on temperature and does not respond to movements
- normalized capacitance can measure movements without responding to temperature

"When an index finger touches an electronic skin, the electronic skin detects contact as a temperature change, and when a finger pushes the skin, the back part of the contact area stretches and recognizes it as movement," said Postech researcher Insang You. "I suspect that this mechanism is one of the ways that the actual human skin recognizes different stimuli like temperature and movement."

Source:https://www.electronicsweekly.com/news/research-news/e-skin-detects-temperature-force-one-sensor-2020-11/

5th gen SuperGaNTM device targets electric vehicles

The TP65H015G5WS, Transphorm's Gen V device, has been designed to address the needs of the Electric Vehicle (EV) market and provides a number of performance enhancements and improved designability. A ccording to the company, the Gen V GaN solution offers the world's lowest packaged on-resistance and delivers a 25% lower power loss over Silicon Carbide (SiC) in a standard TO-247-3 package, strengthening the potential of GaN in the EV power conversion market.

'Transphorm's demonstration of achieving 10 kilowatts of power from a discrete packaged GaN device in a bridge configuration is further validation of the exciting promise of GaN for electric vehicle converters and inverters," said the company's CEO Joachim Fetzer. The SuperGaN Gen V platform incorporates all the learnings from its Gen IV predecessor, patented reduced packaging inductance technology, ease of designability and drivability (Vth of 4 V for noise immunity), and gate robustness of +/- 20 Vmax along with a simplified and reduced assembly structure.

Transphorm has begun sampling the SuperGaN Gen V FET, a 15 mΩ 650 V device, which is unavailable with today's single chip e-mode GaN technology due to its gate sensitivity.

Matching the lowest R available from typical SiC MOSFETs in a discrete package, the solution is capable of driving more than 10 kW depending on the target application, such as EV OBCs and powertrain inverters, power supplies for rack powered data centre servers, uninterruptible industrial power applications, and renewable photovoltaic inverters.

Source: https://www.newelectronics.co.uk/electronics-news/5th-gen-supergantm-device-targets-electric-vehicles/232743/

E Ink and Plastic Logic partner to provide first flexible ACeP-based displays

E Ink, an innovator of electronic ink technology, and Plastic Logic, a designer and manufacturer of flexible, glass-free electrophoretic displays (EPDs), are partnering to provide the first flexible colour displays based around E Ink's Advanced Color ePaper (ACeP) technology.

Plastic Logic's advanced oTFT (organic Thin Film Transistor) displays are high-resolution, lightweight and ultra-low-power and are more rugged than standard glass-based TFTs. Being thinner and lighter makes them suitable for applications such as wearables.

E Ink ACeP is a high quality, colour reflective electronic paper that can produce full colour at every pixel, without the use of a colour filter array (CFA). Currently, E Ink's ACeP display has been used in signage applications that do not require flexible form factors. The addition of Plastic Logic's technology will allow for expansion into applications that can require thinner and lighter weight displays.

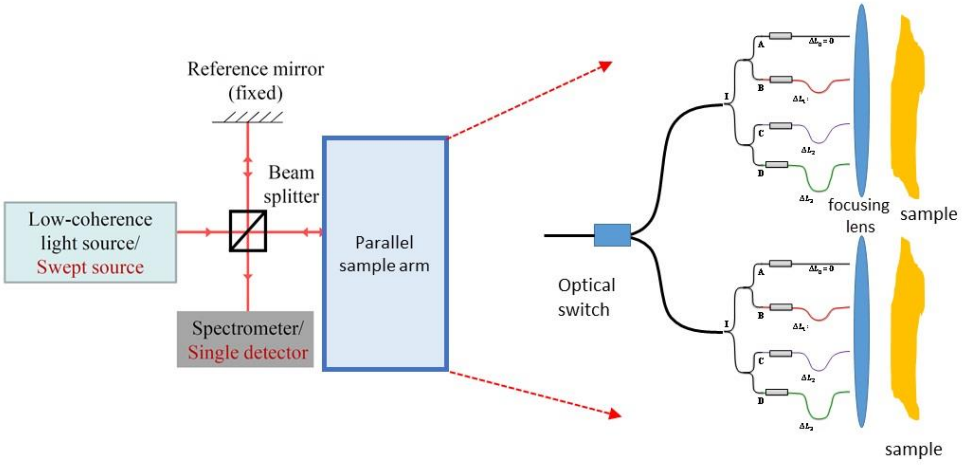
"E Ink is excited to partner with Plastic Logic to offer the world's-first flexible colour display technology to customers," said Johnson Lee, CEO, E Ink. "Plastic Logic's advanced oTFT displays are more robust than traditional amorphous silicon transistors on plastic substrate, which maybe more suitable for wearable applications."

"We are very excited to collaborate with E Ink to provide the market with the world's first plastic displays using ACeP film," said Tim Burne, CEO, Plastic Logic. "Our flexible, glass-free displays are a perfect addition to any wearable technology designer's toolkit - they are extremely lightweight, making them well suited for integration into a host of wearables, including smart jewellery and smart clothing."

Source: https://www.newelectronics.co.uk/electronics-news/e-ink-and-plastic-logic-partner-to-provide-first-flexible-acep-based-displays/232738/

Retinal-imaging breakthrough to swiftly detect eye diseases

European researchers are developing a new real-time scanner that will create a full image of a moving eye without any blurring. Teaming up with photonics innovation hub ACTPHAST 4R the scientists at Vrije Universiteit (VU) Amsterdam are progressing their scanner concept to a demonstrator stage to acquire data faster than existing optical imaging technologies.
Some degenerative eye conditions like glaucoma, diabetic retinopathy, macular holes, and retinal diseases can progress to blindness if they are not diagnosed in their early stages due to missed



opportunities from poor image quality or motion artifacts. Eye specialists currently use an imaging technique called Optical Coherence Tomography (OCT), a non-invasive test that uses light to build up an image of the retina by capturing cross-sectional 'slices'. However, because the eye is constantly moving, the images suffer from blurring and often only partial pictures are possible. OCT technology has never been fast enough to take a full image of a moving eye without blurring or expecting the patient to sit incredibly still.

The lead researcher on this breakthrough development, Assistant Professor Imran Avci from the Department of Physics and Astronomy at VU Amsterdam, said: "Diagnoses of eye diseases that could lead to blindness require good quality images at an early stage.

"Eye abnormalities can be so very subtle in the early phase that standard OCT can miss these tiny changes. Because our eyes are constantly moving to refresh the visual input, even at a microscopic level, it makes eye imaging very difficult without having blurred images.

"Our scanner is different: with the data acquired fast enough, the overall goal is to have a real-time imaging system. The rapid switch will enable us to perform real-time high quality moving footage, or a 'video' of your eye."

Light Bundles

The scanner works by acquiring data from the light signal at rapid speeds by 'bundling' groups of information together. "Our new scanner will acquire the light signal data at least hundred times quicker than OCT systems that exist today. "Taking 100 to 120 reference points, our scanner 'bundles' them together, acquiring 20 arms at a time. However, it is our patented 'switch' that moves from bundle to bundle in nanoseconds that gives us the ability to quickly acquire the images in real-time."

Standard OCT works by collecting data from a single sample arm, which is acquired mechanically using a scanner. The final image is formed by combining these individual images during post-processing. "Processing each sample arm means existing technology is not fast enough to handle constant eye movement. "We can speed up the traditional OCT imaging system while keeping its sensitivity at a reasonable value. Our imaging speed improves while the signal to noise ratio is not sacrificed too much. The faster speed makes it possible to image dynamic situations or fast-moving parts of the body, like the eye.

"The OCT we have today uses a process called 'eye-tracking' which can be tricky and involves many elements to do it right. However, if we can manage to create an image before the eye moves (in 5-10 sec or so) then there is no need for tracking schemes," said Dr Avci.

ACTPHAST for Researchers

Working with ACTPHAST 4R – an EU innovation hub designed to give researchers working in academia throughout Europe access to top-level expertise and technologies in photonics to produce demonstrators for their scientific breakthroughs, similar to the supports provided by the separate ACTPHAST 4.0 innovation hub for European companies, especially for SMEs – Dr Avci's team has been able to access the right technical and business coaching expertise to advance the scanner concept towards an actual product.

ACTPHAST 4R Coordinator, Prof Hugo Thienpont of the Brussels Photonics Team (B-PHOT) at Vrije Universiteit Brussel (VUB) said: "Researchers like Dr Avci do not have easy access to the relevant cutting-edge photonics expertise and technologies within their own universities or even their own regions.

"The ACTPHAST 4R support is crucial to bridging the gap between concept and demonstrator. Only an innovation hub like ACTPHAST 4R can provide the unique cross-border connections for bridging the innovation valley of death and accelerated TRL advancement.

"At this early stage for researchers, it means turning their scientific concepts into practical demonstrators which are cutting-edge and industrially relevant.

If the demonstrator is successful, then they can look at commercialisation options such as licensing or a spin-out company from the university, and taking it to the next stage of a working prototype".

Dr. Avci said: "ACTPHAST 4R has been essential in helping us develop our product because it has de-risked the investment we have to make. ACTPHAST 4R has given us access to the right know-how and equipment to overcome critical photonics challenges, including the invaluable opportunities for hands-on training at the facilities of the top competence centers in the key photonics technologies for our application. They make a huge difference to small research teams like ours".

Specializing in the deployment of cutting-edge photonics technologies, ACTPHAST 4R gives researchers in academic institutes all over Europe the chance to turn their breakthrough scientific concepts into fully-functioning industrially-relevant demonstrators.

"As a 'one-stop-shop' solution for researchers innovating in photonics, ACTPHAST 4R provided rapid access to the technical specialists and cutting-edge technologies in photonics that the team needed in order to further develop the product, and also substantially funded the innovation work. The application process via the ACTPHAST 4R website was quick and easy too".

Source: https://www.techmezine.com/top-10-news/retinal-imaging-breakthrough-swiftly-detect-eye-diseases/