

CDT-UP Newsletter

Centre for Doctoral Training in Ultra Precision Engineering

May 2016



Ultra Precision Engineering Conference, May 2016

The current Ultra Precision MRes cohort held this year's student-led UP conference on Monday 9 May. Speakers from a wide range of disciplines delivered an unusual and stimulating series of talks on such topics as metrology, fusion energy and microfluidics. Presentations from industrial speakers, representing Zeiss and Airbus amongst others, included a lively talk on the ultra precision engineering challenges of future space exploration, and fascinating images from a recently developed Helium Ion microscope. Experts from university and research institutes were also featured, with an impassioned introduction to micro-targets from Rutherford Appleton Laboratory, and an articulate explanation of frequency combs from Heriot-Watt University. The event was very well received by the seventy-five guests in attendance, who finished the day enjoying what turned out to be a brief respite from the rain with drinks and canapés on the IfM terrace. Some of the presentations from the day can be found on <http://www.cdt-up.eng.cam.ac.uk/UPConference>. (Image above supplied by Cranfield University).

Science Festival

The Ultra Precision MRes cohort showcased a range of optical illusions and accompanying posters to explore the behaviour of light waves. In one installation, 4 convex lenses are arranged so as to create an "invisibility cloak" which hides peripheral objects. In another, a clear acrylic pyramid was used in conjunction with

special videos to generate an apparently 3D projection, and visitors were instructed on how to make their own device at home. The third illusion used a two-roomed box built by the students to demonstrate the use of partial reflection to make a ghostly figure appear on a stage.

Francisco ties the knot

Francisco Orozco, PhD student from the Centre for Industrial Photonics, wed Kasia Nadziec on Thursday 21 April at Cambridge Registry Office. They will be formally celebrating in the summer of 2017 in Poland. Congratulations from the CIP Group!



Project Feature: Display motion error reduction through novel binary dithering schemes

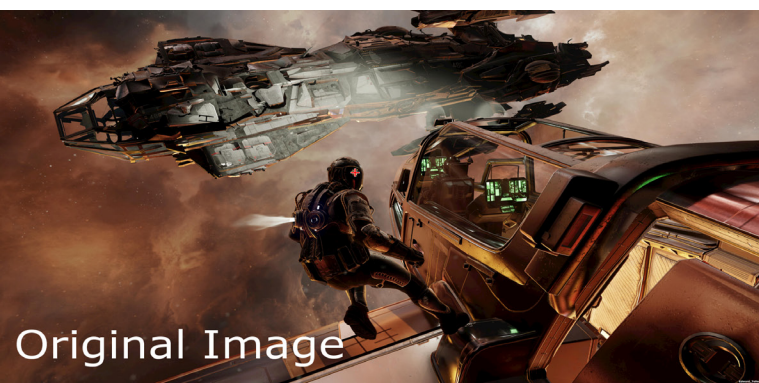
Binary dithering is a technique used to display colour images and video using a two-state Spatial Light Modulator. At each moment, the projected image is only binary - either light or dark at each pixel. However, the human viewer will see a colour corresponding to the average brightness over a short time period, which can be controlled by combining a sequence of images that each contributes a different amount of light.

Binary SLMs such as Digital Micromirror projectors are capable of switching at 50,000Hz, but current displays using them are only capable of producing colour video at around 60Hz. SLMs have desirable properties such as long lifespans and high lighting efficiency through sequential colour, but much better video performance is required for emerging applications such as

virtual reality, so a different approach to using SLMs for video is required.

The focus of this project is finding new methods of binary dithering, and investigating low-latency algorithms to give the best motion performance while minimising losses in colour accuracy. This investigation has yielded promising schemes that in theory allow for video display at 800Hz, with greatly reduced blur, latency and colour breakup. The superior visual quality preservation when tracking a moving display object is shown in the simulated comparison in Figure 1. The current focus is on implementing the new schemes on real hardware (A Vilax DLP development kit), and verifying their speed and accuracy.

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Original Image



Traditional
Temporal Dithering
(60Hz)



Low persistence
OLED
(90Hz)



Novel
Binary Dithering
(800Hz)

5th Interplanetary CubeSat Workshop, Oxford, May 2016

This year's workshop held in Oxford was a resounding success. It brought together engineers, scientists and representatives from all around the world to showcase the latest development in interplanetary nano-satellites using the CubeSat platform. This two-day event included presentations given by space agencies, universities and companies on the progress, challenges, future work and opportunities emerging within the community. There were numerous topics discussed, some of which included astrodynamics, attitude control and determination, communications, launch opportunities, scientific payloads and propulsion along with updates on current missions. The workshop made one thing very clear; CubeSats are capable of interplanetary science at the fraction of the cost of large missions we see today. The first Lunar missions are scheduled for 2018. Watch this space! More information about the conference can be found here: <https://icubesat.org/>, or contact Nadeem Gabbani, ne266@cam.ac.uk.

Save the Date:

Laser FIB: Industrial Applications, 23 June 2016 - Institute for Manufacturing

**Prestige Lecture by Dr. Ir. Jelm Franse from ASML, Precision Mechanics and Mechatronics in ASML
Lithography Equipment – Key Drivers for the Continuation of Moore's Law for
Semiconductor Devices, 28 June 2016 - Cranfield University**