2026 IEEE IMS Workshop Programme, Wellington

Venue: Hunter Building, Kelburn Campus, Room HULT119

Day 1 - 11 November

Time: 1:00 PM - 5:00 PM

Time	Session Title	Speaker
11:30 AM – 1:00 PM	Registration and Lunch	HULT119 Foyer
1:00 PM - 1:15 PM	Conference Opening & Welcome	Ramesh Rayudu
1:15 PM - 1:50 PM	Keynote 1: Operation of a Cryogenic Current Comparator in a Zero Boil-off Condensing Cryostat	Guy Dubuis, MSL
1:50 PM - 2:25 PM	Keynote 2: Position, integration and interference in Public Transport Systems	Stephen Winch, Radiola
2:25 PM - 3:00 PM	Keynote 3: Flight Inspection of Airfield Instrument Landing Systems	Stephen Winch on behalf of Andrew Booth, Radiola
3:00 PM - 3:20 PM	Afternoon Tea Break	ALL
3:20 PM - 3:35 PM	Development and Preliminary Evaluation of a Smartphone-Based Placido-Disc Corneal Imaging System	Fakhruddin Shamsheer Barodawala, ABI
3:35 PM - 3:50 PM	Improving Strawberry Detection Using Time-Series RGB Images	Balasooriya Arachchilage Gayani Indunil Chandrarathne, AUT
3:50 PM - 4:05 PM	Vision-Based Measurement using Proximal Hyperspectral Imaging and Deep Learning	Shah Faisal, Waikato
4:05 PM - 4:20 PM	Development of a Time-Multiplexed Fluid Mixing System for System Identification in Calorimeter	Tingting Fang, ABI
4:20 PM - 4:35 PM	Mapping Marumerisation: Simultaneous classification of pellet shape and size during spheronisation processes	Katharina Goltsche, OTH Regensburg
4:35 PM - 4:50 PM	A method to estimate the detection limit of a foreign object detection system	Kin Wai Lee, Canterbury
4:50 PM – 5:05 PM	Characterisation of electromagnetic signal signatures for foreign object detection in conductive media	Jarrod Zhu, Canterbury
5:05 PM – 5:20 PM	Creating a Flexible MRI Machine for Research	Daisy Hales, Robinson
5:20 PM - 5:30 PM	Day 1 Wrap-up & Announcements	Ramesh Rayudu
5:30 PM – 7:00 PM	Hunter Lounge – Drinks and Pizza	ALL

Day 2 - 12 November

Time: 9:30 AM - 4:30 PM – HULT119

Time	Session Title	Speaker
9:30 AM - 10:10 AM	Keynote 4: Advancing the International System of Units	Murray Early, MSL
10:10 AM - 10:45 AM	Keynote 5: Fibre-Optic Sensing for Fusion Magnets	Bart Ludbrook, Robinson
10:45 AM - 11:05 AM	Morning Tea Break	ALL
11:05 AM - 11:30 AM	Enhancing the Spectral Performance of Surface-Bonded FBG Sensors for Crack Monitoring in Cryogenic Liquid Hydrogen Tanks	Fatima Bibi, Robinson
11:20 AM - 11:35 AM	A Vision-Feedback Mechanical Testing Platform for Realistically Loaded Cardiac Trabeculae	Zehua Li, ABI
11:35 AM - 11:50 AM	Real-Time 6-DOF Electromagnetic Tracking for Gastrointestinal Applications Using Orthogonal Coil Excitation	Savindu Nanayakkara, ABI
11:50 AM - 12:05 PM	In-Situ Soil Moisture Monitoring in Precision Agriculture: Improving Irrigation Water Efficiency	Jorden Nom, Canterbury
12:05 PM - 12:20 PM	Hourly Rainfall Measurement by Fusing Rain Gauges and Satellite Sensors with Self-Supervised Deep Learning	Achmad Pahlevi, AUT
12:20 PM - 12:35 PM	Modelling and Interpretation of an Inline Impedance Sensor for Foreign Object Detection	Niloofar Rezaei, Canterbury
12:35 PM - 1:30 PM	Lunch Break	ALL
1:30 PM - 1:45 PM	Design and Analysis of Impedance Measurement Electronics for Foreign Object Detection	Campbell Suter, Canterbury
1:45 PM - 2:00 PM	Thermal Modulation of Thermosensitive Hydrogels in Needle-Free Jet Injection	Allen Shen, ABI
2:00 PM - 2:15 PM	Design of a Mini Heater and Thermal Flow Sensor for Needle-Free Drug Delivery	William (Zheru) Si, ABI
2:15 PM - 2:30 PM	Single-Receiver Impact Ranging Using Only the A0 Lamb Wave Mode	Sam Spekreijse, Canterbury
2:30 PM - 2:45 PM	Constructing an Avalanching meter to characterise powder flow	Josh Russell, AUT
2:45 PM - 3:00 PM	Time Domain Reflectometry Techniques and Instrumentation	Ian Woodhead, Lincoln Agritech
3:00 PM - 3:20 PM	Afternoon Tea Break	ALL
3:20 PM - 3:35 PM	An Optical Imaging-Based Method for Assessing Water and Starch Adulteration in Milk	Subodhi Marcelline, VUW
3:35 PM - 3:50 PM	Centralised data logger and monitoring: CarbonWatch-Urban	Dylan Sharm, VUW-ESNZ
3:50 PM - 4:05 PM	Conference Closing & Vote of Thanks	Akbar Ghobakhlou

IEEE IMS Workshop 2026 – Authors, Titles and Abstracts

1. Guy Dubuis

Operation of a Cryogenic Current Comparator in a Zero Boil-off Condensing Cryostat

We demonstrate the advantages of combining two off-the-shelf commercial products (A Magnicon CCC system and a Cryogenic Ltd condensing cryostat), resulting in a system that is available for on-demand use for arbitrarily extended periods. Continuous CCC measurements, without loss of SQUID lock, lasting over 10 days have been achieved.

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2. Fakhruddin Shamsheer Barodawala

Development and Preliminary Evaluation of a Smartphone-Based Placido-Disc Corneal Imaging System

Background and Objective: Portable optical instrumentation offers opportunities for accessible, quantitative assessment of the corneal surface. This study presents the development and preliminary evaluation of a smartphone-based Placido-disc imaging system for extracting geometric descriptors of corneal surface irregularity, with keratoconus (KCN) as a proof-of-concept application.

Methods: A custom smartphone-based optical imaging prototype incorporating a Placido-disc attachment was developed to capture corneal reflection patterns for subsequent quantitative geometric analysis. Images from six eyes (three with KCN and three without KCN) were analysed, with KCN status established using a reference topographer (Tomey TMS-5). Image coordinates corresponding to uninterrupted ring indices 4–10 were extracted and processed using geometric ellipse fitting.

Results: KCN eyes exhibited higher ring irregularity than non-KCN eyes and greater centroid dispersion.

Conclusion: The prototype demonstrated the feasibility of extracting quantitative geometric descriptors from smartphone-acquired corneal reflections and lays the groundwork for future improvements in imaging and algorithm robustness.

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3. Balasooriya Arachchilage Gayani Indunil Chandrarathne

Improving Strawberry Detection Using Time-Series RGB Images

Accurate crop detection is essential for automated agricultural monitoring, supporting assessment of crop growth, fruit development, and yield estimation. Most existing approaches process individual images independently and overlook temporal information.

This study investigates whether combining spatial and temporal information from consecutive-day RGB images improves strawberry detection compared with single-frame approaches. The proposed deep learning model achieved a mean average precision of 0.4532, outperforming established baselines, while maintaining a practical model size.

The results indicate that incorporating short-term temporal context can improve strawberry detection accuracy and support image-based measurement and automated crop monitoring in precision agriculture.

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4. Shah Faisal

Vision-Based Measurement using Proximal Hyperspectral Imaging and Deep Learning

Proximal Hyperspectral Imaging (HSI) combines spectroscopy and imaging to provide detailed spectral and spatial information for non-destructive analysis. This work integrates deep learning with proximal NIR-HSI for agricultural, ecological, and forensic applications.

Spectral-only methods were compared with spatial-spectral deep learning approaches including Hybrid U-Net, Attention U-Net, and Hybrid Vision Transformer models. Across multiple applications, spatial-spectral models consistently outperformed spectral-only methods, demonstrating the value of jointly exploiting spectral and spatial information for pixel-level prediction.

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5. Tingting Fang

Development of a Time-Multiplexed Fluid Mixing System for System Identification in Calorimeter

A novel time-multiplexed fluid mixing system has been developed to allow continuous and precise modulation of active-agent concentrations during cardiac muscle

experiments. Integrated with LabVIEW-based control, the system generates complex time-varying concentration profiles with high fidelity.

Using stochastic substrate concentration variations, force and heat production responses from cardiac trabeculae were measured and analysed through system-identification techniques. The platform provides deeper insights into cardiac cross-bridge kinetics and metabolic pathways while enabling advanced pharmacological testing.

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6. Katharina Goltsche

Mapping Marumerisation: Simultaneous Classification of Pellet Shape and Size During Spheronisation Processes

Marumerisation is widely used in pharmaceutical manufacturing to create spherical pellets. This study develops automated image-processing and machine-learning techniques to classify pellets into eight shape classes and six size classes during production.

Results show that, following appropriate preprocessing, the automated system achieves classification performance comparable to manual labelling. This removes a major bottleneck in model development and supports online validation and optimisation of spheronisation processes.

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7. Kin Wai Lee

A Method to Estimate the Detection Limit of a Foreign Object Detection System

This work presents methods for estimating the smallest detectable object using the EMSTREAM electromagnetic sensing prototype. Matched filtering and bootstrap resampling were used to improve signal-to-noise ratio and estimate confidence intervals.

Experiments involving bead objects in aqueous media suggest that the smallest detectable object for the current implementation has dimensions similar to a 2 mm diameter bead.

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8. Jarrod Zhu

Characterisation of Electromagnetic Signal Signatures for Foreign Object Detection in Conductive Media

A novel in-line electromagnetic sensing system was developed to detect foreign objects in conductive food-processing media. The system combines magnetic flux measurements and surface-potential measurements, sampling 320 sensor channels simultaneously.

Experimental validation and simulations demonstrate complementary sensing capabilities for detecting both insulating and conductive foreign objects. Results highlight the potential of the system for food-processing applications.

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9. Daisy Hales

Creating a Flexible MRI Machine for Research

Clinical MRI systems are typically closed platforms that limit research flexibility. This project integrates Resonint's Kahu spectrometer with a compact 1.5 T MRI scanner developed at Te Herenga Waka Victoria University of Wellington.

Calibration and pulse-sequence development enabled the successful acquisition of high-quality multi-slice spin-echo and fast-spin-echo images. The platform provides a flexible and programmable MRI environment for future research and innovation.

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10. Murray Early

Advancing the International System of Units

The International System of Units (SI) continues to evolve following its major 2019 revision. This presentation reviews developments including preparations for the planned redefinition of the second, current concerns related to digitalisation, and challenges within electrical and magnetic units.

The presentation also outlines current activities of the Consultative Committee for Electricity and Magnetism (CCEM) and recent work undertaken by the electrical metrology group at MSL.

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11. Bart Ludbrook

Fibre-Optic Sensing for Fusion Magnets

Fusion devices rely on high-temperature superconducting magnets that are difficult to monitor and protect. This presentation explores the use of Fibre Bragg Grating sensors embedded within magnets to provide distributed measurements of temperature and strain.

The technique offers immunity to electromagnetic interference and can provide early warning of emerging faults. Experimental results demonstrate both the promise and practical challenges of fibre-optic sensing in fusion environments.

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12. Fatima Bibi

Enhancing the Spectral Performance of Surface-Bonded FBG Sensors for Crack Monitoring in Cryogenic Liquid Hydrogen Tanks

This study investigates surface-bonding techniques for Fibre Bragg Grating sensors used in cryogenic structural health monitoring. FBG sensors were bonded to G10 composite specimens and characterised during thermal cycling to liquid nitrogen temperatures.

Results show that shorter bonding lengths improve strain transfer while reducing peak splitting, intensity loss, and spectral broadening. The findings support the deployment of FBG sensors in future cryogenic hydrogen storage tanks.

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13. Zehua Li

A Vision-Feedback Mechanical Testing Platform for Realistically Loaded Cardiac Trabeculae

A vision-based mechanical testing platform was developed for studying cardiac trabeculae under realistic physiological loading conditions. The system combines image-based displacement tracking, force measurement, and real-time feedback control.

Proof-of-concept experiments demonstrated effective force and length control under a range of contraction modes, providing a versatile platform for cardiac mechanics research.

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14. Savindu Nanayakkara

Real-Time 6-DOF Electromagnetic Tracking for Gastrointestinal Applications Using Orthogonal Coil Excitation

This work presents a compact electromagnetic tracking system for six-degree-of-freedom localisation of nasogastric tubes. Three orthogonal transmit coils and a miniature magnetometer are used to achieve millimetre-scale localisation accuracy.

Validation demonstrated localisation errors as low as 1.6 mm in benchtop testing and approximately 2.2 mm in vivo, supporting the feasibility of real-time gastrointestinal tracking.

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15. Jorden Nom

In-Situ Soil Moisture Monitoring in Precision Agriculture: Improving Irrigation Water Efficiency

This research evaluates a microwave soil-moisture sensor using buried Vivaldi antennas to interrogate larger soil volumes than conventional point sensors.

Simulation studies demonstrate that carefully designed antenna enclosures can maintain stability in soil environments, with ongoing work aimed at experimental validation and deployment in precision agriculture.

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16. Achmad Pahlevi

Hourly Rainfall Measurement by Fusing Rain Gauges and Satellite Sensors with Self-Supervised Deep Learning

Flood forecasting requires rainfall estimates with both high temporal and spatial resolution. This study introduces SSL-RainNet-G, a self-supervised framework that combines rain gauges, Himawari imagery, GPM-IMERG rainfall products, and elevation data.

Under spatial cross-validation, the system achieved an R^2 of 0.769 and RMSE of 0.567 mm/h, outperforming conventional interpolation methods without requiring radar data.

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17. Niloofar Rezaei

Modelling and Interpretation of an Inline Impedance Sensor for Foreign Object Detection

This work investigates an inline impedance sensor for foreign-object detection in dairy pipelines. Finite-element simulations and geometry-based models were developed to characterise sensor response as a function of object size and sensor geometry.

Results explain how sensing-region spacing, insulating gap length, and object size affect conductance changes and detection performance.

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18. Campbell Suter

Design and Analysis of Impedance Measurement Electronics for Foreign Object Detection

This paper presents the design and analysis of measurement electronics intended to detect foreign-object contaminants in aqueous food and beverage products through impedance changes measured by an inline sensor.

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19. Allen Shen

Thermal Modulation of Thermosensitive Hydrogels in Needle-Free Jet Injection

This study investigates how temperature affects thermosensitive hydrogels used in needle-free jet injection. A temperature-controlled injection platform was developed to measure injection performance, fluid pressure, jet velocity, and rheological properties under varying thermal conditions.

Preliminary testing demonstrated effective closed-loop temperature control and lays the foundation for detailed evaluation of hydrogel delivery systems.

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20. William (Zheru) Si

Design of a Mini Heater and Thermal Flow Sensor for Needle-Free Drug Delivery

This project investigates miniature resistive heaters and a thermal flow sensor for improving needle-free jet injection of viscous formulations.

Experimental evaluation of conductive adhesives and surface-mount resistor heaters identified practical approaches for rapid local heating, while thermistor-based flow sensing demonstrated sensitivity to flow-rate changes.

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21. Sam Spekreijse

Single-Receiver Impact Ranging Using Only the A0 Lamb Wave Mode

A single-receiver acoustic ranging technique is presented for thin metal plates using only the dispersive A0 Lamb-wave mode. Range estimation is performed through correlation between measured and modelled signals.

Experimental testing achieved RMS ranging errors of approximately 1 mm on steel sheets and 3 mm on aluminium plates.

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22. Josh Russell

Constructing an Avalanching Meter to Characterise Powder Flow

A benchtop rotating-drum instrument was developed to characterise dynamic powder-flow behaviour. The system uses camera-based image analysis to monitor avalanche behaviour and powder-surface geometry.

Preliminary testing showed that metrics based on surface geometry offer improved discrimination between dry and moist milk powders compared with avalanche interval alone.

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23. Ian Woodhead

Time Domain Reflectometry Techniques and Instrumentation

This presentation reviews the principles and instrumentation of Time Domain Reflectometry (TDR), including applications in PCB testing, moisture measurement, and fault detection in transmission lines.

Recent technological advances have significantly reduced instrumentation cost while maintaining measurement performance.

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24. Subodhi Marcelline

An Optical Imaging-Based Method for Assessing Water and Starch Adulteration in Milk

This work explores a low-cost optical imaging method for detecting milk adulteration through analysis of droplet evaporation dynamics and dried-droplet morphology.

Results indicate that drying time, droplet profile, image intensity, and crystal-structure formation provide useful indicators of water dilution and starch addition.

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25. Dylan Sharm

Centralised Data Logger and Monitoring: CarbonWatch-Urban

CarbonWatch-Urban is a programme that maps carbon dioxide sources and sinks across New Zealand using a mobile sampling laboratory equipped with multiple environmental sensors.

This project developed a centralised live data acquisition and monitoring platform that integrates instrument outputs and provides real-time status information to operators. Testing demonstrated successful operation, although packet loss of approximately 1.1% remains a limitation.

This list follows the programme order and excludes programme items for which no matching abstract was available in the spreadsheet.