

ADVANCING TECHNOLOGY FOR ENVIRONMENTAL MEASUREMENT



Program



✓ Speakers



✓ Networking
Lunch



✓ Breakout
Sessions

OCT. 1, 2024

9:00 AM - 4:30 PM, QNC 1501



UNIVERSITY OF
WATERLOO

FACULTY
OF SCIENCE



WATERLOO INSTITUTE FOR
nanotechnology



GEMM

Agenda

OCT. 1, 2024, ET

Start	End	Event
8:30 AM	9:00 AM	Doors Open and Sign-In
9:00 AM	9:40 AM	Opening Remarks <ul style="list-style-type: none">• Dr. Sushanta Mitra, Professor, Mechanical & Mechatronics Engineering, Executive Director of WIN• Dr. David Clausi, Professor, Associate Dean, Research & External Partnerships, Systems Design Engineering• Dr. Donna Strickland, Professor, Physics and Astronomy, 2018 Nobel Laureate• Dr. Johanna Wandel, Professor, Acting Dean, Geography and Environmental Management• Dr. Chris Houser, Professor, Dean, Earth and Environmental Sciences
9:40 AM	10:20 AM	Panel Discussion: Challenges in Environmental Measurement Panelists: <ul style="list-style-type: none">• Dr. Chris Houser, Professor, Earth and Environmental Sciences• Dr. Maria Strack, Professor, Geography and Environmental Management• Dr. Francis Poulin, Professor, Applied Mathematics• Dr. Peter Crank, Assistant Professor, Geography and Environmental Management
10:20 AM	10:40 AM	Talk #1: Inertial Gas Sensors: A Robust Environmental Monitoring Technology <ul style="list-style-type: none">• Dr. Eihab Abdel-Rahman, Professor, Systems Design Engineering; WIN Core Member
10:40 AM	10:50 AM	Break

Agenda

OCT. 1, 2024, ET

Start	End	Event
10:50 AM	11:50 AM	Breakout Group Session #1 Discussion Questions: <ol style="list-style-type: none">1. What environmental parameters have measurement challenges?2. What gaps, limitations or barriers are there for technologies that could address environmental measurement challenges?3. What are the strengths or focus areas at the University of Waterloo we could take advantage of to advance technology for environmental measurement? Moderator: <ul style="list-style-type: none">• Simon Glauser, Managing Director, Waterloo Climate Institute
11:50 AM	12:30 PM	Plenary Session Presentations from breakout groups and further discussion.
12:30 PM	1:30 PM	Lunch - will be provided in QNC-1501
1:30 PM	1:40 PM	Afternoon Overview <ul style="list-style-type: none">• Dr. Sushanta Mitra, Professor, Mechanical & Mechatronics Engineering, Executive Director of WIN
1:40 PM	2:00 PM	Talk #2: Detection of E. Coli in Drinking Water <ul style="list-style-type: none">• Dr. Sushanta Mitra, Professor, Mechanical & Mechatronics Engineering, Executive Director of WIN

Agenda

OCT. 1, 2024, ET

Start	End	Event
2:00 PM	2:20 PM	Talk #3: Artificial Intelligence Approaches to Address Environmental Challenges <ul style="list-style-type: none">• Dr. Vassili Karanassios, Professor, Chemistry, WIN Connected Devices Leader, WIN Core Member
2:20 PM	3:20 PM	Breakout Group Session #2 Discussion Questions: For the University of Waterloo to advance technology for environmental measurement and monitoring: <ol style="list-style-type: none">1. What infrastructure or capabilities are required?2. How can we create collaborations and networking across faculties?3. What funding opportunities or partnerships are available? Moderator: <ul style="list-style-type: none">• Simon Glauser, Managing Director, Waterloo Climate Institute
3:20 PM	3:30 PM	Break
3:30 PM	4:10 PM	Plenary Session Presentations from breakout groups and further discussion.
4:10 PM	4:30 PM	Wrap-Up: Closing Remarks and Future Directions <ul style="list-style-type: none">• Dr. Sushanta Mitra, Professor, Mechanical & Mechatronics Engineering, Executive Director of WIN• Dr. Donna Strickland, Professor, Physics and Astronomy, 2018 Nobel Laureate
4:30 PM	4:30 PM	End of Workshop

Presenters



Eihab Abdel-Rahman

Professor, WIN Core Member, Systems Design Engineering

Eihab Abdel-Rahman is Professor of Systems Design Engineering. His research interests are in the nonlinear dynamics of electromechanical and biomechanical systems, particularly Micro- and Nano-Electronic Mechanical Systems (MEMS/NEMS) sensors, actuators, and energy harvesters as well as workplace ergonomics.

TALK:

Inertial Gas Sensors: A Robust Environmental Monitoring Technology

Prof. Abdel-Rahman will discuss his group's and the wider micro and nanotechnology community's recent achievements in inertial gas sensors. This sensor class is now at TRL6 - TRL7 ready to meet the challenges of creating and enforcing a regulatory framework to implement policies to address climate change, such as taxation of carbon and regulation of methane emissions, to monitor air pollution, and to detect hazardous gases. It can deliver multi-gas sensor nodes with at the form-factor, cost, and capabilities to deploy sensor networks to provide localized and real-time environmental monitoring networks.

Presenters



Sushanta Mitra

WIN Executive Director, Professor, Mechanical and Mechatronics Engineering

Sushanta Mitra is a full Professor in the Department of Mechanical & Mechatronics Engineering and is cross-appointed as a Professor of Chemical Engineering, Electrical & Computer Engineering, Physics & Astronomy, and Chemistry at the University of Waterloo. He serves as the Executive Director of Canada's largest nanotechnology institute – the Waterloo Institute for Nanotechnology (WIN). Before joining Waterloo, he had several administrative roles in Canadian higher education, including Department Chair (Lassonde School of Engineering), Associate Vice-President Research (York University) and Assistant Vice-President Research (University of Alberta). He also served as the President of the Canadian Society for Mechanical Engineering. For his contributions to science and engineering, he has been elected a fellow of several professional organizations, including the Canadian Academy of Engineering, the Royal Society of Chemistry, the American Physical Society, the Electrochemical Society, the American Association for the Advancement of Science and a foreign fellow of both the Indian National Academy of Engineering and the National Academy of Sciences India. He has an entrepreneurial mind, being the Founder & CEO of a Canadian startup, Aquabits Inc. (on quantum technology) and a Dutch startup, SLE Enterprises B.V. (on ultra-fast encapsulation technology), supported by the University of Waterloo.

TALK:

Detection of E. Coli in Drinking Water

E. coli stands as a crucial indicator for assessing potable water quality. Rapid detection of these waterborne pathogens, especially in resource-limited settings, remains a formidable challenge. This presentation will unveil the innovative journey behind cutting-edge water quality monitoring tools like the Mobile Water Kit and Dip Test. Additionally, it will showcase groundbreaking, cost-effective solutions in water treatment, exemplified by the transformative Dip Treat technology.

Presenters



Vassili Karanassios

Professor, WIN Connected Devices Leader, WIN Core Member, Chemistry

Vassili Karanassios' interests are in the area of micro- and nano-analysis (e.g., metrology), in micro- and nano-technology (e.g., micro- and nano-fluidics, nano-materials), and in development of miniaturized instruments that can be used on-site (i.e., in the field). Such instruments are typically fabricated on-chips so that they can fit in the palm of a hand or in a shirt pocket, thus allowing users to take "the lab to the sample". The sample may be a "patient" (for early diagnosis of disease) and the field may be a health clinic or the environment (e.g., the air we breathe or the water we drink). In addition, such instruments are being developed to have wireless-capabilities so that they can be included in the Internet of Things (IoT) and to have some smarts (via Artificial Intelligence, primarily using Artificial Neural Networks and Deep Learning approaches).

TALK:

Artificial Intelligence Approaches to Address Environmental Challenges

Artificial Intelligence (AI) and related topics (e.g., Machine Learning, Deep Learning), have been receiving attention in many areas of science and technology [1, 2], and have recently been incorporated into the UN's environment program [3]. In this presentation, AI approaches used to address environmental challenges will be discussed.

[1] C. Tat and V. Karanassios, "Artificial intelligence (and related topics, e.g., Machine Learning, Deep Learning, Artificial Neural Networks or ANNs) as applied to the teaching and to the practice of analytical spectrochemistry", Proc. of SPIE, 0277-786X (2024); Invited; DOI: 12.3013600

[2] Z. Li, X. Zhang, G. A. Mohua and V. Karanassios, Artificial Neural Networks (ANNs) for spectral interference correction using a large-size spectrometer and ANN-based Deep Learning for a miniature one, Invited, open access book chapter (<https://www.intechopen.com/chapters/57282>), Chapter 12, Pages 227-249, InTech Publishing, Dec. 20, 2017, DOI: 10.5772/intechopen.71039.

[3] <https://www.unep.org/news-and-stories/story/how-artificial-intelligence-helping-tackle-environmental-challenges>