Present and future of control and automation in desalination and water reuse

Abstracts / Program

❖ **Continuous evolution of control technology - 20 min**

❖ **Digital Transformation of Reverse Osmosis Plants – 20 min**

❖ **How machine learning improves RO plant performance and reduces OPEX – 20 min**

❖ **Q&A – 10-20 min**

Moderator

Dr. Maria Kennedy

BIOGRAPHY

Maria D. Kennedy (BSc (Hons.) in Industrial Chemistry & PhD from the University of Limerick, Ireland) is Professor of Water Treatment Technology at IHE Delft Institute for Water Education.

Professor Kennedy has 11 years of research experience and currently specializes in research and development in the field of membrane technology, including microfiltration, ultrafiltration, reverse osmosis and electrodialysis for potable and industrial water treatment and water reuse.

Her main research areas of interest are membrane fouling (indices), membrane scaling and cleaning. Professor Kennedy is also involved in international training projects in Israel (West Bank) in the field of desalination of brackish/sea water.

Co-Moderator

Ana M. Blanco-Marigorta

BIOGRAPHY

Ana M. Blanco-Marigorta is Professor of Chemical Engineering at Las Palmas de Gran Canaria University, Spain. She received her Doctorate (Ph.D.) with honors in Chemistry in 1997 from the University of La Laguna, Spain. She obtained a degree in Chemistry at the University of Valladolid (Spain) and an Engineer degree in Energy Technologies at the Universidad Nacional de Educación a Distancia (UNED), Spain.

During 2004-2006 she was on a Postdoctoral stay at the Energy Engineering Institute of the Technische Universität Berlin, Germany. Since then, she has participated in several research projects dealing with Exergy Analysis in energy conversion processes. Her research interest focuses on thermodynamic optimization of energy systems through exergy methods, (exergoeconomic, exergoenvironmental,…).

She is co-author of a number of papers indexed in the JCR, 8 book chapters and two books. She has also co-directed 28 M. Sc. and two Ph.D. Theses. She has participated in several projects obtained through agreements with private companies and she is co-author of one patent.

Prof. Blanco-Marigorta has been Visiting Professor at the Technische Universität Berlin (Berlin, Germany), the Universitá degli Studi di Firenze (Firenze, Italy), the Escuela Superior Politécnica del Litoral, (Guayaquil, Ecuador) San Diego State Univiersity (San Diego, California, USA) and Marquette University (Milwaukee, Wisconsin, USA). She has participated in two international training innovation projects regarding energy-water interactions, and more specifically in the area of Water Management and Desalination Engineering.

Dr. Victor Yangali Quintanilla

Lead Water Treatment Specialist at GRUNDFOS

BIOGRAPHY

Victor works as Water Lead Specialist in Grundfos, a world leading pump and water treatment equipment company. With 21 years of experience in water treatment through consultancy, construction and research and development (+30 journal publications, 4 patents, 1 book and 1 book chapter); Victor has been driving water technology at different stakeholder's layers. His main interests are water reuse and desalination, process automatization, computer/control simulations and data analysis. He holds a MSc in Municipal Water from UNESCO-IHE, Institute for Water Education, and a PhD in Advanced Water Treatment from Delft University of Technology, both in the Netherlands. Victor sees himself as a water professional finding the balance between science/innovation vs. engineering to allow the transition of the water sector from the traditional school of the 90's into the 00-20's of the new millennium where new technologies, controls, sensors and data are already redefining water industry standards

Abstract

❖ Continuous evolution of control technology - 20 min

The water industry is witnessing a continuous evolution of control technology that goes beyond measurements and surveillance of water quality, processes, and operational parameters. In applications of water reuse and desalination, controls and automatization of water treatment systems are becoming even more relevant since the importance of a reliable system operation is highly demanded. End-users and OEMs are experiencing a transition from systems with limited performance surveillance and data collection to systems where process control, data collection and surveillance are perceived as added value for OEMS and likewise for end-users. The webinar presentation about control and automatization will first introduce the topic, to further elaborate and give a broader understanding of what is required to make the integration of sensors and controls into an extra layer of automatization.

Subir Bhattacharjee

CEO, IntelliFlux Controls

BIOGRAPHY

Subir Bhattacharjee is the founder and CEO of IntelliFlux Controls, a Platform as a Service (PaaS) company bringing digital transformation for process industries since 2017. Subir possesses over 25 years of experience in process engineering research, consulting, product development, and sustainability. Previously, as the CTO of Water Planet, Inc. (2011 – 2017), he was the chief architect of three award winning water technology products: Integrated Membrane Systems (IMSTM), PolyCera® – a new membrane capable of separating oil from water, and IntelliFlux® – a software platform for intelligent automation, each becoming the foundation of separate technology businesses. IMS won the Oil & Gas West Coast Sustainability Award in 2014, PolyCera won the Technology Idol Distinction in 2013, and IntelliFlux was awarded the Technology Idol in 2016 at the Global Water Awards. Prior to joining Water Planet in 2013, Subir was a Professor in Mechanical Engineering at the University of Alberta, Canada, for 12 years, holding several positions, such as the Industrial Research Chair in Water Quality Management for Oil Sands Extraction, the Director of the Oil Sands and Coal Interfacial Engineering Facility, and Canada Research Chair. He advised oil & gas, water, process equipment industries, as well as government agencies regarding technology adoption and process optimization for industrial water management. He was the recipient of the Petro-Canada Young Innovator Award.

Subir holds a professional engineering license in Alberta, Canada since 2006. He has co-authored a book titled "Electrokinetic and Colloid Transport Phenomena," has published over 100 journal articles (h-index 43), eight book chapters, and co-authored 18 patents/patent applications.

Abstract
❖ Digital transformation of Reverse Osmosis plants - 20 min

Sustainable, reliable, and economical operation of reverse osmosis (RO) plants is a complex and challenging task that not only involves maintaining the health and performance of the reverse osmosis process at optimal levels for the life of the plant, but also involves carefully attuning and optimizing the pre-treatment, chemical conditioning, biofouling mitigation, brine (waste) management, and post treatment reconditioning of the RO permeate.

IntelliFlux Controls has provided autonomous control and model predictive process optimization at many types of RO plants, spanning remotely located sea water desalination plants, large drinking water plants, purified water production plants, and industrial

wastewater reuse applications. Our digital automation technology installs as a retrofit upgrade to already operating (brownfield) RO plants, whereby we update the automation programs of the plant to enable the following:

(i) Gathering plant information into a consolidated data-stream,

(ii) Continuously processing the data to develop an updated knowledge base regarding the performance changes at the plant,

(iii) Utilizing a digital twins as well as various machine learning and predictive analysis tools, converting the knowledge into process wisdom and instructions that provide the plant operators advanced notifications about impending maintenance issues, or insightful guidance and solutions to avoid problems.

(iv) Depending on the pre-existing automation levels, IntelliFlux also provides autonomous and adaptive control of many plant functions, such as chemical pre-treatment, coagulant dosing, cleaning of pretreatment steps (such as Ultrafilters), and optimization of flux and recovery in RO trains.

In summary, we enable conversion of existing RO plants into "smart RO plants" through our digital transformation platform.

In this webinar, we will discuss selected results from different RO operations upgraded by IntelliFlux, showing how digital transformation can lead to better and more insightful management of these plants, providing operators the ability to proactively manage influent water quality excursions, lower the frequency of element cleaning and CIP, reduce downtime, and improve overall plant recovery. These enhancements lead to direct reduction of energy intensity of these RO operations and enhance the sustainability of these plants by increasing membrane module life.

Mike Dixon

CEO, Synauta Inc

BIOGRAPHY

Dr Mike Dixon is a global expert in desalination and water treatment technology working with membrane and thermal technologies in Australia, North America, the Middle East, the Caribbean and Asia. Mike has worked across the entire value chain with technology manufacturers, water utilities, oil and gas companies, pharmaceutical companies and research hubs.

Mike is the CEO and Founder of Synauta Inc, a cleantech startup working with desalination innovators with a goal is to reduce energy and chemical use using data science and machine learning.

Prior to Synauta, Mike was Chief Technology Officer for WaterNEXT (Canada's Water technology accelerator) and Applications Development Manager for NanoH2O, a global provider of reverse osmosis membranes that leveraged UCLA developed nanotechnology to lower the cost of desalination with over 300 installations in 40+ countries in the three years from market launch. LG Chem acquired NanoH2O in 2014.

Mike is experienced with the development of intellectual property and the commercialization of new technologies. He has more than 60 publications in international journals and is an author of several books and book chapters.

Mike is currently a Director of the International Desalination Association (IDA) Board. He has been an Editor of the IDA Journal and a reviewer for the Journal of Membrane Science and Water Research. Mike was National President of the Young Water Professionals for the Australian Water Association and in 2012 won the prestigious IDA Fellowship Award.

Abstract

❖ **How machine learning improves RO plant performance and reduces OPEX – 20 min**

Reverse osmosis requires a lot of energy and chemicals to produce water and costs plant owners millions of dollars every year. Optimizing a plant manually, to match the design conditions, takes time that operators do not always have. Additionally, optimization is made more difficult when a plant has multiple trains to track performance and optimize manually.

Synauta has developed machine Learning algorithms to help plant operators produce the right quantity and quality of water, without the distraction or need for lengthy calculations that require several assumptions that can often be inaccurate. Of note is that where the reverse osmosis math has limitations, machine learning was found to be more accurate. Machine learning was also codified and deployed to SCADA to predict variations/trends in water temperature and salinity, ultimately minimizing energy use and adapting to consistently fluctuating feedwater conditions. In terms of chemical reductions, Synauta's algorithms predict the best time to clean, saving OPEX costs by avoiding membrane degradation and optimizing the total cost of cleaning, rather than simply optimizing to either chemical costs or membrane life. Synauta's algorithms have been proven to save as much as 20% OPEX costs on RO plants of 1,000m3/day to well over 200,000m3/day all over the world including the Middle East, Australia, Europe and North America, working with the world largest companies providing RO operations services.

As a cleantech startup Synauta is collaborating with desalination innovators who share the goal of reducing energy and chemical use through data science and machine learning. Using our solution the global desalination industry can also save more than 12 million tonnes of CO_2 every year.

In this presentation we will discuss Synauta's solution, deployment methods, the mechanics of machine learning and present results from several Case Study plants.