30 June 2021 (Wednesday)

7.00pm-8.30pm (SGT) (GMT +8)
Session 2.7 – Intelligent Plant of the Future

Session Chair(s): Peter Grevatt, The Water Research Foundation (USA)

Next Generation Of Process Monitoring And Diagnostics: Applications Of AI And Machine Learning To Enable Early Equipment Fault Prediction And Diagnostics

A. Minisankar, K. Ghosh, GK. Sivaprakasam. Yokogawa Engineering Asia Pte Ltd (Singapore)

Water treatment plants are a conglomeration of different unit processes, controls and associated auxiliary equipment. Rotating equipment forms an integral part of any water treatment plant. Late/missed detection of equipment failures in water treatment plant results in unexpected down time or plant shut down disrupting the water supply chain. After detecting a fault, finding the root cause and deciding the right course of action is time consuming and depends on the level of expertise of the plant operators. Yokogawa Singapore is developing a Machine-learning based Early Fault Detection & Diagnosis system to monitor a rotating equipment in operation, detect a fault at initiation, pinpoint the root cause, and alert for corrective maintenance with suggested remedial actions. It builds a baseline machine learning model of the equipment performance under normal operation and uses it to monitor its health status in real time and predict a fault much before it is observed. The diagnostics tool identifies the most probable root cause based on previous equipment failure patterns and provides the possible failure resolution methods based on the historical maintenance records.

Advanced 3D Modelling For Virtual Piloting: Accelerating The Development Of The Next Generation Water And Wastewater Treatment Technologies

W. Audenaert, U. Rehman, J. Plooij, I. Nopens. AM-TEAM (Belgium)

Virtual design and virtual piloting based on advanced computational fluid dynamics (CFD) has a great potential to accelerate the development of new water and wastewater treatment technologies. Advanced CFD incorporates process phenomena such as bubbles, particles and (bio)chemical reactions. This novel type of modelling is used to reduce, replace or compliment 'real-life' testing with significant savings in time and cost as a result. Three different examples from the drinking and wastewater fields were described to illustrate the practical application.

Improving Operational Efficiency Through Alarm Management In Water Treatment Processes Using Artificial Intelligence

K. Ghosh. Yokogawa Engineering Asia Pte Ltd. (Singapore)

Water Treatment Plants are controlled by modern industrial process control systems like SCADA or DCS. These systems usually generate far too many alarms than needed. Many of the alarms are nuisance in nature and do not indicate any real abnormality. The true alarms which requires prompt operator actions to normalize the process are often buried in the pool of nuisance alarms causing significant challenge for operator to take appropriate corrective actions in a timely manner. In this paper, we propose an AI based pattern mining and advisory system to improve operational efficiency in alarm management by providing intelligent decision support to the operators. The identified alarm patterns bring out actionable insights in data by (i) identifying nuisance, chattering, redundant, and consequential Alarms (ii) Alarm response procedure (iii) prediction of Alarms.The efficacy of the proposed method for systematically improving alarm management in an actual plant environment is currently being studied in a water treatment plant in Singapore with promising results.

Machine Learning For Reverse Osmosis Shows Up To 18% Energy Savings

M. Dixon, N. Palmer, J. Quaintance, K. Brockman, N. Herold, T. Pritchard, H. Le, C. MacLean. Synauta (Canada)

Seawater Reverse Osmosis (RO) requires a lot of energy 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 and control room operators do not always have. Additionally, optimization is made more difficult when a plant has multiple trains to track performance and optimize manually. Synauta's patent pending technology helps plant operators produce the right quantity and quality of water, without the distraction of lengthy calculations. Where math has limitations, Machine Learning is accurate. Machine Learning can also be codified and deployed to SCADA to predict variations/trends in water temperature and salinity and undertake multiple set point changes per day, ultimately minimizing energy use and adapting to consistently fluctuating feedwater conditions. To achieve energy savings, Synauta alters the RO plant recovery. By frequently analyzing plant operating conditions the recovery can be varied to achieve optimal energy use while still conforming to the main plant design constraints, such as lead element recovery, lead element flux constraints.