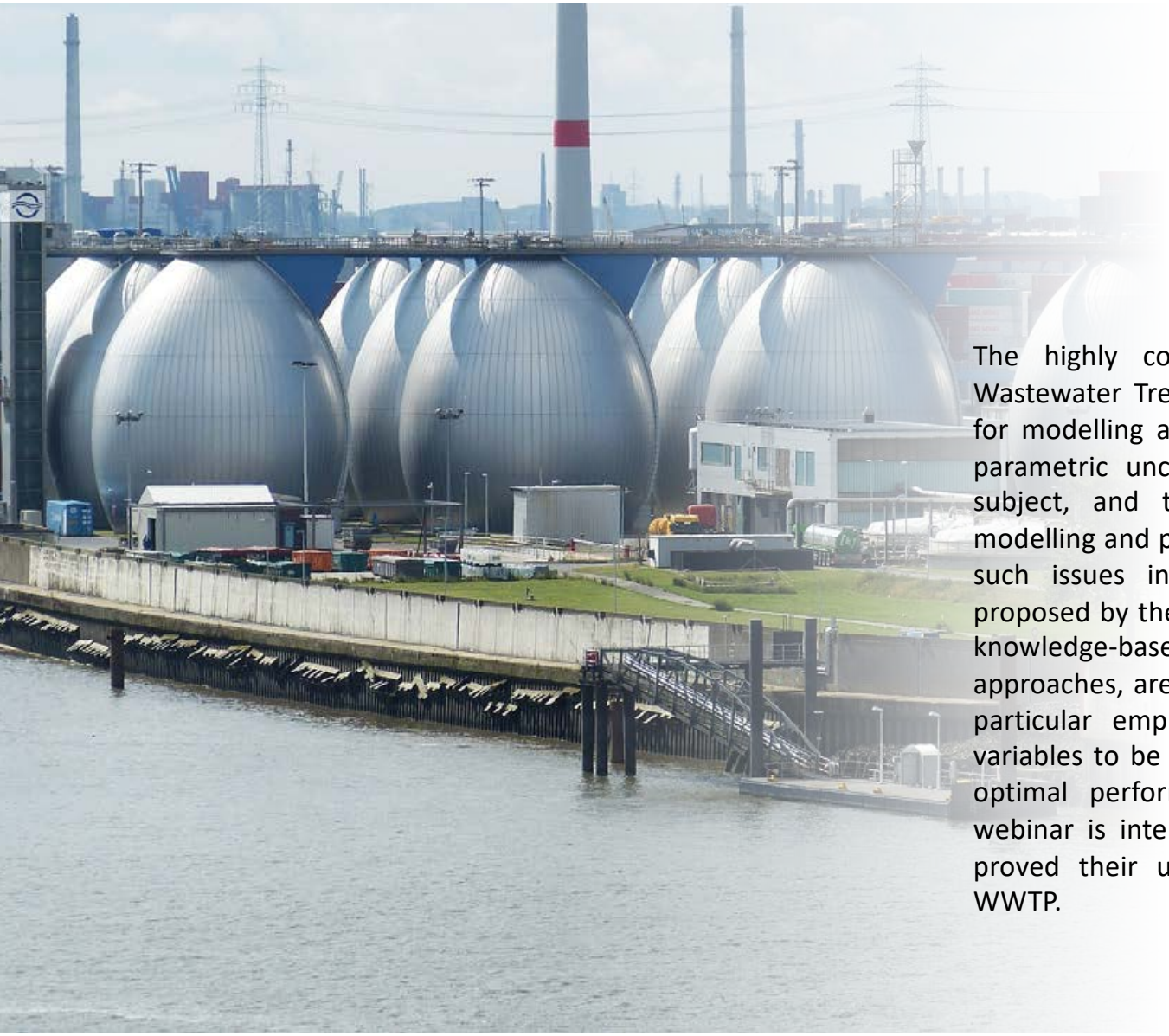
EXCEED-SWINDON
INTERNATIONAL NETWORKS
INVITES

WEBINAR

MODELLING AND CONTROL OF WASTEWATER TREATMENT PLANTS

August 26th 2021



Overview

The highly complex biological and biochemical nature of Wastewater Treatment Processes is one of the main challenges for modelling and control of such processes. This includes also parametric uncertainties and disturbances to which they are subject, and that affects their performance. Thus, various modelling and process control techniques have been used to face such issues in different ways. Typical deterministic models proposed by the International Water Association (IWA) as well as knowledge-based ones; like neural networks and fuzzy approaches, are used for general and specific applications where particular emphasis is placed on the main parameters and variables to be monitored and controlled in order to ensure the optimal performance of Wastewater Treatment Plants. This webinar is intended to present different approaches that have proved their usefulness in the modelling, and regulation of WWTP.

TIME SCHEDULE

August 26th 2021		
TIME (GMT)	**TOPIC**	**PRESENTER**
13:00 - 13:15	Welcome adress	Dr. Victor Alcaraz-Gonzalez / Prof. Andreas Haastrick University of Guadalajara / Technical University of Braunschweig
13:15 - 13:25	Introduction: Why Engineering in WWTP?	Dr. Victor Alcaraz-Gonzalez University of Guadalajara
13:25 - 13:50	Coupling the biochemical and thermochemical biorefinery platforms to enhance energy and product recovery from distillery solid residues	Dr. Jorge Arreola-Vargas Texas A&M University
13:50 - 14:15	Modeling and control of wastewater treatment plants : Objectives, challenges and some solutions	Dr. Jean-Philippe Steyer INRAE - Univ de Monpellier
14:15 - 14:40	Monitoring of WWTP by State Estimation	Dr. Victor Alcaraz-Gonzalez University of Guadalajara
14:40 - 15:05	Nonlinear Control Approaches in WWTP	Ph.D. Victor Gonzalez Alvarez University of Guadalajara
15:05 - 15:20	Q & A	
15:20 - 15:25	Conclusions	

KEYNOTE SPEAKERS

Victor González Alvarez

Prof. Víctor González Álvarez holds a B.S. degree from the University of Guadalajara, México and a Ph. D. degree from the University of Minnesota, U.S.A., both in Chemical Engineering. His research interests focused on the design and implementation of nonlinear robust monitoring and control techniques in chemical and biochemical processes. He has authored and co-authored more than 200 research papers in peer review journals and conference proceedings, edited 3 books and held 3 patents. He has supervised 30 Ph.D. and 72 M.S. students. Prof. González Álvarez was the Dean of the University of Guadalajara (UDG) Institute of Technology (2004-2010), and later he was in charge of the (UDG) Graduate School and Research System were his duties focused on the quality assurance of all graduate programs and the establishment of technology transfer policies at UDG.

Jorge Arreola Vargas

Dr. Arreola does research in biorefinery and wastewater treatment for the production of chemicals, biofuels and removal of emergent contaminants. He holds a PhD in Environmental Sciences from IPICyT (CONACyT research center in Mexico) and currently works at Texas A&M University as an Associate Research Scientist. During the last 7 years, he has developed different pretreatment technologies for the production of chemicals and biofuels from Tequila industry solid residues including chemical and physicochemical treatments. Dr. Arreola has participated in more than 10 projects funded by U.S, U.K and Mexican agencies and has led three of those research projects. His productivity includes 50 refereed publications in academic journals, book chapters and conference proceedings.

Jean-Philippe Steyer

Jean-Philippe Steyer is senior scientist at INRAE-LBE in Narbonne, France. His research interests include modeling and optimization of biological processes for waste and wastewater treatment and valorization together with innovative real-time instrumentation systems and life cycle analysis to account for environmental impacts. He also broadens his fields of applications, with anaerobic digestion as the core bioprocess but integrating it with innovative processes such as microalgae cultivation for bioenergy and bioproducts sustainable production. JP Steyer is also currently Deputy Leader of the INRAE Division TRANSFORM about “Science for Food, Bioproducts and Waste Engineering” and co-director of the INRAE metaprogramme on “Bioeconomy for urban areas”.

Coupling the biochemical and thermochemical biorefinery platforms to enhance energy and product recovery from distillery solid residues

The tequila industry is one of the pillar industries in many regions of Mexico, bringing wealth and economic development to rural areas. However, appropriate disposal and management of the tequila manufacturing residues such as the Agave tequilana bagasse (TB) represent not only an environmental challenge but also an economic opportunity. Previous works have unsuccessfully applied biochemical routes for complete TB valorization. Therefore, this talk aims to show how the full conversion of TB to energy and products by coupling the biochemical and thermochemical biorefinery platforms can be achieved. The energy recovery can be optimized by applying a central composite design and using hydrolysates as substrates. Overall, experimental results indicate that coupling the biochemical and thermochemical platforms for Agave tequilana bagasse can be a novel approach to refining gaseous and liquid products and extracting heat energy while disposing the bio-waste from tequila industry.

Modeling and control of wastewater treatment plants : Objectives, challenges and some solutions

Wastewater treatment processes are highly efficient biological processes with specific requirements in terms of instrumentation, control and automation. Non linearities, slow and fast dynamics, uncertainties in process parameters, highly complex models, large changes in the process inputs are among the main characteristics. This presentation will discuss the main challenges associated to these characteristics (in terms of on-line sensors needed, modelling efforts and mathematical complexity) but also the advantages and drawbacks of different control strategies that have been applied in practice over the last 15 years.

Non linear Control Approaches in WWTP

This talk focuses on the experimental implementation of a control approach for the regulation of volatile fatty acids (VFA) in continuous anaerobic digestion processes. The robust scheme is made of an output feedback control, and an extended Luenberger observer, which is used to estimate the uncertain terms of the process (i.e., influent concentration and process kinetics). The control scheme is implemented in a pilot plant up-flow fixed-bed reactor that is treating industrial wine distillery wastewater. The performance of the robust scheme is tested under different set-point values and several uncertain scenarios, including model mismatch, badly known parameters, and load disturbances. Experimental results show that the VFA concentration can be effectively regulated over a wide range of operating conditions. The control scheme has a structure that improves its performance in the presence of noisy measurements and control input saturations. The performance of this kind of robust control scheme is particularly encouraging to scale it up to real-life industrial applications. This methodology includes the advantages of proportional integral and proportion integral differential (PI/PID) control and the robustness of the nonlinear control schemes.

Monitoring of WWTP by State Estimation

In this talk, a kind of robust state estimation approaches (ROAs) are shown as a powerful tool to estimate key variables in wastewater treatment processes, like anaerobic digestion, under scenarios highly uncertain. These schemes combine the use of commonly used models like the well-known IWA Anaerobic Digestion Model No. 1 (ADM1), and the AM2 model, as well as state observers and a minimum number of to reconstruct the unmeasured process variables within a guaranteed threshold. The performance of these robusmeasurementst estimation schemes is evaluated via both numerical simulations and actual experimental scenarios. It is shown that under some structural and operational conditions, these ROAs have the property of remaining stable in the face of uncertain process

MODERATORS

Andreas Haarstrick
Technical University of Braunschweig

Andreas Haarstrick has studied of Chemistry at the Technische Universität Braunschweig (1983 – 1989) and received his doctorate in 1992 in the field of biotechnological up- and and downstreaming processes of biopolymers. Since 2006, he is Professor for Bioprocess Engineering at the TU Braunschweig. His teaching and research interests cover modelling biological and chemical processes in heterogeneous systems, development of models predicting pollutant reduction in and emission behaviour of landfills, growth kinetics at low substrate concentrations under changing environmental conditions, Advanced Oxidation Processes (AOP), and groundwater management. Since 2012, he is the managing director of the DAAD exceed-Swindon project dealing with the sustainable water management in developing countries.

Victor Alcaraz Gonzalez
University of Guadalajara

Victor Alcaraz-Gonzalez is a Chemical Engineer by Universidad de Guadalajara (UdeG) in 1991, and received his PhD degree in Engineering Sciences from Université de Perpignan in France in 2001. Since 2002, he is a Member of the (Mexican) National Researchers System and from 2004 he is also a regular member of the Jalisco Sciences Academy. He has more tan 130 publications in Indexed Journals and International Conference Proceedings. Currently he is Full Professor Researcher Titular C at the Department of Chemical Engineering, at UdeG, and founder member of the Bioprocess Engineering Research Group (CA-496) at the same university. The current research topics and interests of Dr. Víctor Alcaraz-González deal with modeling and control of bioprocesses for wastewater treatment, focusing on obtaining energy and added-value products from wastewater