

Mathematical modeling of wastewater treatment processes has become more and more popular in the recent years. Objective of this course is to provide strong background and experience to understand and apply mathematical models powerfully and conscientiously. In particular, the concepts of model-based control strategies will be explained and practical applications to modern wastewater treatment plant will be provided and discussed providing convincing reasons for controlling the plants.



AALTO UNIVERSITY
SCHOOL OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF CIVIL AND
ENVIRONMENTAL ENGINEERING

WATER ENGINEERING RESEARCH GROUP
TIETOTIE 1 E, 02150 ESPOO

GUSTAF OLSSON

Course on

**MODELING AND
CONTROL OF
WASTEWATER
TREATMENT
PLANTS**

27-30 APRIL 2010

**AALTO UNIVERSITY
SCHOOL OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF CIVIL AND
ENVIRONMENTAL ENGINEERING**





GUSTAF OLSSON

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Gustaf Olsson is a Professor emeritus in Industrial Automation, Lund University (Sweden), since 2006. Prof. Olsson is a Part time professor in Electrical Power Systems at the Chalmers University of Technology, Göteborg, Sweden.

He has devoted his research to control and automation in water, wastewater, power and process industries. Prof. Olsson has guided 23 PhDs and a few hundred MSc students to their exams. The Lund University engineering students have elected him as the “teacher of the year”. He has spent extended periods doing research at universities and companies in the USA, Australia, Japan, Malaysia, and China and has been invited to lecture in 16 countries outside Sweden. He has authored eight books - published in English, Russian, German and Chinese - and more than 130 scientific publications. Since 2005 he is the editor-in-chief of Water Science and Technology and is also member of the IWA Board of Directors.

COURSE SCHEDULE

Every session will include theoretical lectures followed by practical computer exercises

APRIL 27, 2010

9:00 -16:00

- WHY CONTROL OF WWTPs?
- PROCESS MODELS AND THEIR APPLICATION IN WWTP CONTROL

● Community or societal goals ; Care for the surroundings environment and for the society in which the plant operates; Process or plant goals; To meet effluent discharge requirements - To achieve good disturbances rejection - Minimizing energy and chemical requirements.

● Models for biological nutrient removal - The activated sludge models; Models for control, models for diagnosis; Simulators

APRIL 28, 2010

9:00 -16:00

- CONTROL METHODS IN WWTPs
- PLANT-WIDE CONTROL

● State of the art - Sources of disturbances - Disturbance rejection - Application aspects of the main control strategies for conventional and nutrient removal plants; The importance of actuators; Case studies: Model application examples in the definition of optimal control strategies.

● Motivation for plant wide control. Energy efficiency; Optimal control - Constraint control - Case studies

APRIL 29, 2010

9:00 -16:00

- INSTRUMENTATION AND MONITORING FOR WWTP OPERATION
- DATA SCREENING AND FILTERING - MONITORING
- WATER AND ENERGY - A CLOSE LINK

● On-line sensors - State of the art - Sensor characteristics - Measurement principles; Off-line measurements Main parameters to be measured in the lab and related reference methods.

● Data visualisation - Outlier tests - Missing data in time series - Time distribution - Frequency content of time series;

● Estimation of key performance monitoring parameters

APRIL 30, 2010

9:00 -12:00

WASTEWATER TREATMENT PLANT VISIT (**HELSINKI - VIIKINMÄKI**)

COURSE MATERIAL

Books:

Olsson, G. and B. Newell (1999). *Wastewater Treatment Systems. Modeling, Diagnosis and Control*. IWA Publishing, London

Olsson, G., Nielsen, M., Yuan, Z., Lynggaard-Jensen, A., Steyer, J.P. (2005). *Instrumentation, Control and Automation in Wastewater Systems*, IWA Publishing, London.

Course material will be delivered in class (reprints from books and lecture handouts).

Computer sessions will be performed in Matlab environment.