

Model based predictive control

Prediktor AS

DESCRIPTION:

The overall aim of the project is to design, implement and validate a control structure for efficient WWT plant operation. The control structure will be based upon a Model Predictive Control (MPC) technology where a simplified process model together with estimation techniques is used to minimize a cost function. This cost function is represented by a prediction of defined quality parameters related to a desired set-point.

APPLICABILITY AND PRE-REQUISITES:

In the project setting, the MPC's objective will be to increase/maintain the purification level of the effluent water while reducing the main operation costs (energy and chemical additives). Furthermore, disturbance rejection is another important capability of the MPC, where the goal is to minimize the effect of flow disturbances into the plant. The MPC shall have a supervisory controlling/planning role with respect to the existing PID controllers. In other words, in this set up, the MPC controller would define the set point values for the PID controllers.

ADVANTAGES AND DISADVANTAGES:

The solution will optimize the treatment operation both in a quality (purification) perspective and in terms of resources usage (chemicals and energy). The technology (concept) will be applicable for a range of scenarios, possible with some model re-parameterization or re-configuration.

The technology will be relevant for a range of various plant configurations. However, there will be some plant requirements related to instrumentation and actuators.

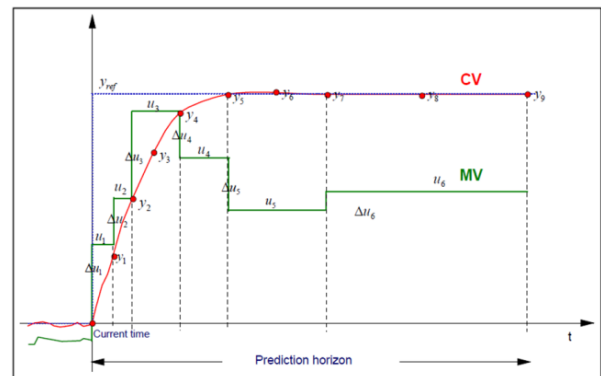
OPERATION AND MAINTENANCE:

In operation, the solution will require limited O&M activities. During operation, the solution will need to be monitored as an integral part of the conventional automation system. Related to maintenance, some model adaptations could be required, especially related to changes to the physical plant configuration.

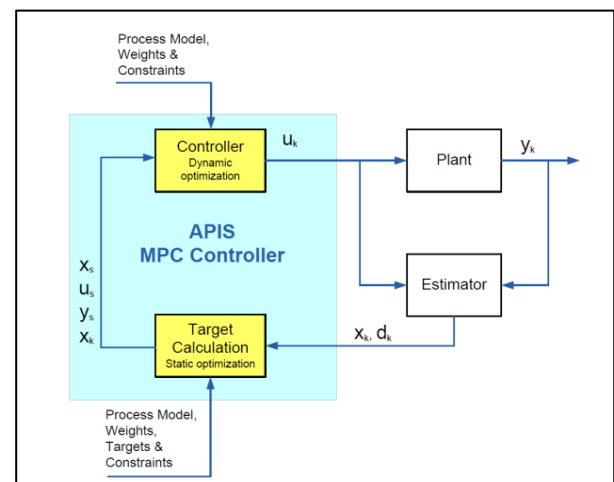
COSTS:

CAPEX: Ballpark EUR 75.000,- (assuming instrumentation in place)

OPEX: Ballpark EUR 5.000,- /year (manpower for maintenance other than existing automation)



Typical MPC response curves into the prediction horizon



Prediktor MPC block diagramme

REFERENCES:

- [1] *Realising Full-Scale Control in Wastewater Treatment Systems Using In Situ Nutrient Sensors*, Pernille Ingildsen, Lund University 2002
- [2] *Benchmarking of Control Strategies for Wastewater Treatment Plants*, ISBN 9781843391463
- [3] <https://opcfoundation.org/about/opc-technologies/opc-ua/>

The control structure will be implemented and tested at Sjöstadvärket pilot plant in Sweden.

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