

# CA10 project-proposal: Model Predictive Control of a sewer system

As a part of a new research project the municipality of Fredericia wants to investigate the possibilities of minimizing the discharge of harmful material to the recipient of wastewater, while also minimizing the energy consumption and CO<sub>2</sub> emission from the wastewater treatment plant.

The sewer system consists of a number of tubes in a grid leading the wastewater to the wastewater treatment plant. Some tubes receive both wastewater and rain water, in other parts of the city wastewater and rain water is kept in separate systems. Systems with rain water will be equipped with overflow possibilities to prevent large amounts of rain to cause overflow in buildings. Also rain water bassins can be a part of the system in order to give possibility to temporarily hold back dirty water until the sewer system and the treatment plant has capacity to transport and clean the water.

Fredericia is special in the way that a number of large industries (brewery, dairy, refinery) requires a large capacity of the wastewater treatment plant. Some of these industries discharge occasionally large amounts of heavily contaminated wastewater over short time.

In the research project the idea is to build in a number measurement wells with sensors allowing for early detection of wastewater amounts and/or concentrations which call for special actions.

Also in the project an intention is to build in special gates to redirect or hold back water where bassins or large tubes have capacity to store wastewater giving the possibility to smoothe out the flow of water and contaminants such that the wastewater plant is stressed as little as possible. As a part of the research project detailed models of the sewer system will be developed at Department of Civil Engineering.

In this master project the objectives are

- Build a simplified model describing the dynamics of the sewer system or a part of it using simplified hydraulics and emphasising storage possibilities.
- Add concentration of important contaminants by including equations for component balances including conversion of matter.
- Develop a performance function and suitable constraints to form the basis for evaluation of a controller performance.
- Use the model, performance function and constraints to develop a controller to operate the sewer system.

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