

# HYBRID MODELLING OF WASTEWATER TREATMENT PLANTS

## Introduction

Wastewater treatment plants are mostly modelled by mechanistic models. These models incorporate physical knowledge into a set of differential equations. However, the incorporated knowledge is inherently a simplification of reality. The resulting error propagates and worsens the performance of these models. With more and more data available, data-driven models are gaining considerable attention. These models determine the model structure by searching for relationships in data. They can make highly accurate predictions and do not require domain knowledge. However, they fail in regimes not seen before. Combining both approaches is a promising way to improve the modelling of wastewater treatment plants.

## Methodology

Neural differential equations have recently been introduced as a data-driven variant of conventional differential equations. By formulating the neural network as a set of differential equations, it can easily be incorporated into an existing model of a wastewater treatment plant. The data-driven component thus fills in the simplifications in the mechanistic model, thereby improving its predictive power.



**Figure 1 – Modern wastewater treatment plants produce plenty of data, but often are data graveyards.**

## Objectives of the thesis

This thesis aims to incorporate a data-driven component into a mechanistic model of a wastewater treatment plant. The student should have a basic knowledge of programming and a motivation to learn about mechanistic and data-driven modelling techniques.

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