

# Knowledge-informed Gaussian Process Model Predictive Control for Chemical Processes

## Proposal for a Bachelor's Thesis Project

Developing dynamic models of chemical processes are essential for the simulation, control, and optimisation of the process. Models can be obtained through theoretical, empirical, or semi-empirical means. Theoretical approaches use the principles of chemistry, physics, and biology to develop high fidelity, complex models. These models are applicable over wide operating ranges and provide clear physical insight but are time consuming to develop and some model parameters might not be readily available. Empirical approaches use experimental data to describe the relationships of the investigated parameters. Artificial neural networks is a common approach that is used to develop models in a short amount of time. However, these models require a large amount of data which is costly and are only valid over the training range. Semi-empirical approaches combine theoretical and empirical aspects to achieve a compromise.

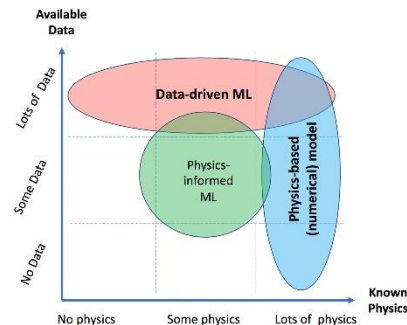
Confidence in the model's prediction is important for implementation but large datasets are costly to generate for chemical processes. Gaussian process regression is a Bayesian approach that is capable to provide the uncertainty with the predictions while having a good modelling performance on small datasets. The accuracy of the predictions can be improved by including knowledge from the process such as mass and energy balances. The scope of this project is to use Gaussian process regression that is informed by process knowledge to develop a process model. This process model will be further use in a Model predictive controller for controlling the process.

The following prerequisites will be useful for the project:

Experience with /  
knowledge about: Gaussian process regression and  
Model predictive control

Programming skills: Python or Matlab

Language: English



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