MPC tuning based on optimization

Model predictive is a controller widely used in process industry. In the design of model predictive control (MPC), there are some parameters to be tuned, which is important in order to have good performance of process. Tuning usually needs an expert and a lot of time to spend since different test should be done. Therefore, we have used numerical optimization to tune the parameters automatically and save time and energy.

In this respect, defining a good performance function is important. There has been proposed four types of optimization problem in Matlab to tune the mentioned parameters.

The aim of this project is:

1) Applying the different types (Four problems are defined and the codes are provided as Matlab function) of optimization problem on different processes (Tank level control, Distillation process, Paper machine process, …)
2) Running all optimization problem by Matlab solvers
   a. *fmincon*
   b. *multistart*
   c. *gs* (Global search)
   d. *patternsearch*
   e. *ga* (Genetic Algorithm)
3) Providing different performance tables
   a. Time consumed for each optimization problem versus each solver
   b. The minimum value of cost function versus each solver
   c. a and b should be repeated for all process (Tank level control, Distillation process, Paper machine process, …)
   d. In each problem it is important to check if the constraints are fulfilled and show the feasibility in a separate table versus solver
4) Documenting the results

It should be noted the student will be briefed in the beginning of the project and all the initial Matlab codes will be provided. The task is to check different optimization method in different process and decide what optimization method is better in what process.

At the end of this project we expect to choose the best cost-function and Matlab solver/solvers in general model predictive control optimization problem.

It should be noted that, the potential students may have opportunity to do their master thesis at ABB Corporate Research.