

MPC Feed-Forward for constraint handling

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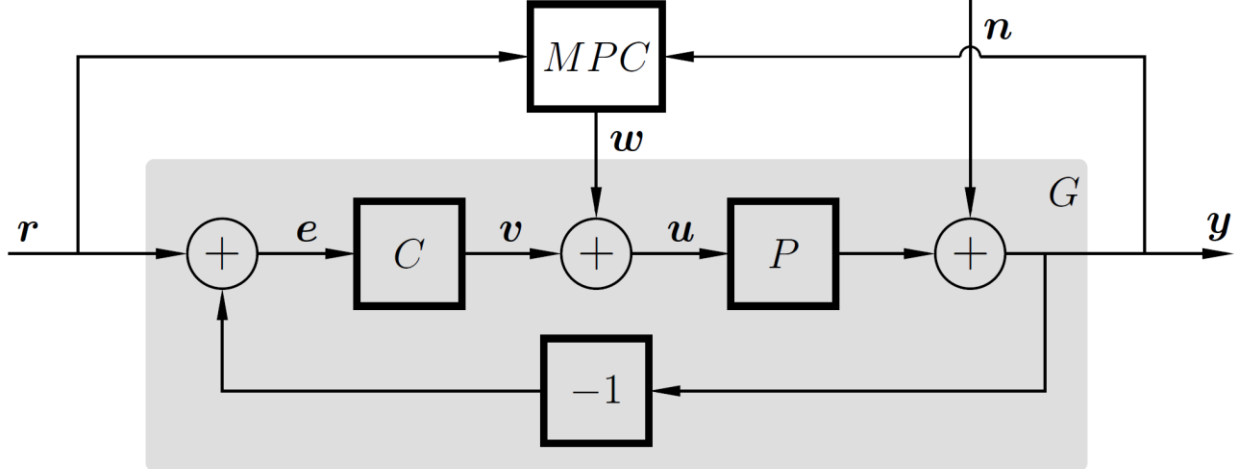


Figure 1. Block diagram of the MPC feed-forward control structure.

In the process industry, many processes have well established old control structures tuned over generations to function well during nominal operating conditions. In some processes, the performance during nominal production is prioritized over the worst-case disturbance rejection, as worst case disturbances are relatively uncommon. The worst-case disturbance handling is often left unaddressed if it does not cause risks, but that does not have to be the case. To complement the existing control structure with an MPC controller, solely dedicated to constraint handling is one way to address constraint handling during worst case disturbances, without changing the control performance during nominal operating conditions.

When an MPC controller is added to the control structure as in Figure 1, the MPC controller is not designed with only the process it is intended to control in mind, instead, the MPC design is conducted with the full closed loop system G , in the gray box, as its process model. This gives the MPC the ability to predict the closed loop dynamics and hence, the MPC can be designed to only interact with the system when the control signal v , from the inner controller is not sufficient to avoid constraint violations, for example at worst case disturbances.

The control structure presented above has been implemented at one of Boliden AB:s concentrators to guard level constraints in a buffer tank ahead of a flotation bank. This way, the tuning of the inner controller C can be done without taking worst case disturbances into account for the benefit of the nominal performance, while the MPC handles the worst-case disturbances. This presentation will discuss the current setup and motivation behind it, as well as showing results from the currently running pilot application in the Aitik concentrator.

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