Stochastic MPC for optimal operation of hydropower plant

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Introduction and background:

Although the application of MPC was originally designed to be applicable in the field of chemical processes, MPC now has been of immense interest in a wide range of fields including hydropower plants. The ability of MPC to handle uncertainties that may occur in the system and realization of constraints in the process variables are the major features researchers in the field of hydropower are attracted to and motivated to implement MPC in this sector.

Problem description and objective:

The operation of hydropower production is directly associated with the water available in the reservoir, and it is always desirable to maintain the maximum water level in the reservoir. However, the unforeseen circumstances due to weather change result in the uneven water quantity in the reservoir. One situation may be unanticipated flooding in the reservoir, resulting in water overflow, while another could be a water deficit in the reservoir. In both scenarios, the proper operation of the water handling mechanism, known as flood gates, becomes crucial for water resource management.

The main objective of this thesis is to design a SMPC that can handle inflow uncertainties in Lake Toke and determine the optimal flood gate openings to maximize water levels in the reservoirs.

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