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1 *The Donau-Reservoir Melk in Austria benefits from optimization technologies developed by the Fraunhofer AST*

BARRAGE CASCADE CONTROLLING SYSTEM

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Background

During a year especially in humid mountainous regions many heavy rainfalls will occur. These heavy rainfalls will result in a flood. Also snow melting processes can produce water in a dangerous amount.

People, industry or environment around such rivers need to be protected. Navigation protection and Energy maximizing are secondary goals. Decision makers, who control the barrages, need to consider all of these facts. Thus it is too difficult for persons to judge all the criteria's together, non optimal control trajectories will be chosen. It's also a fact that many barrages and reservoirs just could care about the local impact of the control trajectories.

A lack of a controlling software system to deal with this multiple criteria optimization problem appears.
A system, which could optimize the trajectories for a bunch of barrages is needed.

Methods

Local controllers are modeled using a fuzzy controller. The fuzzy controller inside is using four different PID controllers. The four different controllers are used for modeling the different phases of a flood. These local controllers are connected to a global coordinator. This global coordinator gets in every time the current situation from all local controllers.

With the information about the local situations and with the flood prediction the global coordinator could calculate the optimal trajectory for each connected local controller. This calculated trajectory will be transmitted to the local controllers, which now could control their barrage to the global optima.

Due to this is an multiple criteria problem, the weights for all criteria's has to be set in the controller. That means it has to be determined how important navigation, flood control and energy production are. After the coefficients are set, the optimization will find an optimal trajectory.

The resulting trajectories will operate the barrages and reservoirs in this way that the flood will be reduced barrage by barrage. That means the more barrages are controlled together, the better will the system perform, the more additional energy will be produced. The system should be used if its possible to combine three or more barrages. Single barrages could be modeled with the system, but the improvement is too small.

For using this software it's needed to built up a simple model of the stream course with the barrages. Several flow stations are needed inside the stream course. Knowing the specific generator characteristics allows optimizing the energy production.