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SIMULATION AND CONTROL OF FLOODS IN A WATER NETWORK. CASE STUDY OF JIJIA RIVER CATCHMENT

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Abstract

Floods have long been the cause of severe human and economic loss. Structural measures are applied to minimize the consequences of these natural disasters. A potential mitigating approach is the design and implementation of a control strategy for the water network aimed to regulate the water flowing within the river catchment system. There are several tools that have the ability to model and forecast the flood events in water networks. However, some tools are limited in the ability of providing suitable model for the control design purpose. First, in the present work the full, diffusive and kinematic St.Venant models have been implemented in simulators. Following the performance analysis of the developed simulators, the diffusive model was chosen for model based control. Subsequently, investigations have been carried out for controlling the water level at a designated point of the catchment, in the presence of flood wave disturbances. A software tool was developed in the MATLAB and Simulink environment for simulation and control in the water network. Model Predictive Control using both feedback and the combination of feedforward and feedback configurations was chosen as model based control algorithm due to its capability of directly exploiting the process model for prediction and coping with the pure time delay of the water network. The developed simulation and control tool was applied for the case study of mitigating flood effects in the Jijia River Catchment. Results of the simulations serve as demonstration of the proposed control approach potential for diminishing the flood wave effect by automatic control.

Key words: flood control, hydrologic model, Model Predictive Control

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