

The Application of the Fuzzy Set Theory in Natural River, to study Flood Risk Analysis as Function of its Hydraulic Parameters

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Abstract. A mathematical model based on the Saint-Venant hydrodynamic equations, combined with fuzzy set theory, is developed in order to study the influence of hydraulic parameter of Natural River on the flood risk. To do so, the set of differential equations, in FUZZY formulation, is solved by numerical difference method, so that the membership functions of all control variables related with the flow could be calculated. With base in these membership functions the model is capable of evaluating the fuzzy risk for such area subjected to the flood process during intense rains. A computer program QUARIGUA (Risk Quantitative Analysis of Flooding in Urban Rivers) is used to perform the simulations. The computer program QUARIGUA is organized in a modular manner, with two main modules: the deterministic module, where the depth of the water in the river and the flow of the channel are calculated as discrete values; and the fuzzy module, based on the fuzzy set theory, where the depth of the water and the flow are calculated as membership functions. The simulations demonstrate the reliability, versatility and computational efficiency of the proposed model to evaluate fields of risk and reliability in hydrodynamics systems.

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