ГРАЂЕВИНСКИ ФАКУЛТЕТ СУБОТИЦА

Објављен рад

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A novel form of the lattice Boltzmann method for sediment transport and morphological changes is developed and implemented. The depth averaged shallow water equations (SWE) have been used to reach the flow pattern, the advection–diffusion equation (ADE) was exploited to determine sediment concentration in the water, bed load was determined by the active layer mass conservation equation (ALMC), while the morphological changes of the river bed were determined by the global active layer mass conservation equation (GALMC), the Exner equation. The SWE are solved by the multiple-relaxation-time lattice Boltzmann method, (MRT-LBM), while the Bhatnagar-Gross-Krook (BGK-LBM) approach has been used for solving the ADE, ALMC and GALMC. New forms of the equilibrium function for solving the ALMC and GALMC are presented, using the D2Q9 lattice. Dedicated sediment-related equations are created for each sediment-size class. Additional dedicated terms in the transport equations take care of particle exchange between the suspension and the river bed, as well as of river bed deformation. The model has been verified on a experimental section of the Danube river. The results have been compared to the measured ones, and to the results obtained by the finite difference method (FDM). Very good agreement between the results is achieved, indicating that the LBM can be successfully used for simulation of flow and sediment related processes in natural watercourses, characterized by complex geometry and morphology, and lack of uniformity in sediment composition.