MALTI-LAYER FINITE ELEMENT ANALYSIS OF FLOW GENERATED IN A LAKE WITH UPSTREAM DIFFERENCE IN TIME DISCRETIZATION

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Kojima Bay is connected to Seto Inland Sea, which separates the main island of Japan and Shikoku Island. A part of the Kojima Bay was isolated from the rest by a bank to become a lake called Kojima Lake. There are six gates set on the bank, and those gates are opened when it is necessary to discharge water from the Kojima Lake into the Kojima Bay in order to control the water level of the lake. In such an event, a current is generated in the lake. Currents generated in the Kojima Lake are studied numerically by multi-layer finite element analysis of partial differential equation of the dynamics of flow. We implement an upstream difference technique in the weighted averaged approximation in time discretization of a substantial derivative. Experimental and/or measuring techniques to utilize the global positioning system in analyses of currents are also introduced. The position of the GPS-float was recorded every second during an experiment. The spatial and temporal data are then transmitted via a wireless modem to be uploaded into a PC. On the other hand, the driving force of the GPS-float is the fluid resistance on the pair of rectangular plates attached to the GPS-float. The fluid resistance can be given in terms of the water velocity, and the velocity of the flow determined by the finite element analysis is introduced into momentum equations of the GPS-float to simulate its motion. The experimental result can betested against the numerical result in order to validate the numerical result for the flow.

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