SUMMARY

The study is concerned mainly with prediction of the complex water hammer pressure fluctuations in surge tank and pressure conduit of hydropower plant.

The main phase of the thesis is the parallel theoretical and experimental studies of pressure fluctuations within the surge tank when the valve at penstock is suddenly closed. Theoretical study of the above situation leads to the development of a numerical solution of the nonlinear equations of continuity and momentum for a surge tank. Two different methods are based on a finite difference scheme. Here provision is made for replacement of the friction factor by the logarithmic resistance law, thereby taking care of flow conditions from turbulent to fully laminar.

Experimental works on the same situation have been carried out in a fabricated laboratory model of sufficient pipe length. This had a constant head reservoir upstream and a surge tank at the downstream end. The author's numerical solutions in both the methods have been assessed to be satisfactory from the comparison with the experimentally obtained points. Comparison of author's solution in the above situation has also been made with those of previous investigators. Reasonably close agreement has been found.

In the last phase of this work, nonlinear equations of continuity and momentum in pressure conduit without a surge tank have been solved numerically. The Method of Characteristics and
the Lax finite difference scheme in x-t plane were adopted. A clearout pattern of fluctuations and then damping of discharges and pressures within the pressure conduit at difference sections with increase of time has become prominent. The solutions obtained by these methods have been compared with Streeter's solution. A close agreement is obtained.

Considerable change of friction factor value with increase of time has been displayed in both phases of the work. It is probable that for the first time such evaluation of friction factor value at every time step has been incorporated in the four numerical solutions of the above two phases of work. Finally, recommendations have been put forward for possible extension on the author's work.