# CHAPTER VII

# CONCLUSION AND SCOPE OF FURTHER WORK

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In chapter III the applicability of multilayer group method of data handling algorithms for identifying the parameters affecting the river flows during a short span storm period has been demonstrated. Mathematical description of river flows has been obtained correlating the up-stream flows at different gauging stations with that of a down-stream gauging station for which one step ahead prediction of flow is required. Thus one step ahead prediction of flow of the river Teesta at Coronation Bridge Point has been obtained correlating the lagged instant flows at different up-stream gauging stations. Modelled values of flows are found to simulate adequately the observed values.

This investigation is going to be useful for flood forecasting as well as designing the dam to be constructed near the Coronation Bridge Point.

The capability of multilayer GMDH to forecast river flows quite sufficient ahead of time of occurrence has been demonstrated. It is possible to predict flow of the river Teesta at Domohani Road Bridge near Jalpaiguri town on the

basis of a sixth hourly minimum gauged readings at the up-stream region at the Coronation Bridge Point and other gauging stations.

The realistic prediction of river flow during a storm period is essential to protect life and property of the down-stream region as well as to effect flood control and irrigation measures.

Multilayer GMDH has been applied to identify rainfall run off characteristic of Teesta river system. Possibility of correlating, in the form of well defined polynomial, the rainfall-run off during a short span storm period has been investigated. Mathematical description is found to simulate the variation of flows at a predetermined gauging station with the variation of integrated lagged instant rainfall in the up-stream catchment region.

With adequate data pertaining to distribution of rainfall in the catchment region available it seems possible to predict the flow well in advance and with greater accuracy.

In this chapter multilayer group method of data handling algorithms have been extensively used to identify the physical processes involved during a short span storm period.

This investigator is of the opinion that if the data for different storm periods covering a number of years were available it would be possible to identify the time varying characteristics of the flow process of the Teesta river system. Further investigational efforts are needed in this direction. And it is hoped that if this investigation is carried out a new light will be thrown on the soil characteristics of the Himalayan region covering the Teesta river basin.

In chapter IV a simple dynamic model of hourly flow of the river Teesta at Domohani Road Bridge Point has been presented with a minimum of sixth lag instance in the measurement of up-stream flows using a heuristic learning identification technique known as combinatorial group method of data handling algorithms. The model has been verified by simulation against field data observed during a short span storm period. Beauty of this model lies in its simplicity. It is observed that this model is more accurate than the model obtained through the complex process of decision regularisation as in the case of multilayer group method of data handling algorithms. To make this model general in application further investigation is needed to be carried out with data for different storm periods covering a number of years so as to being out the time varying characteristics of the parameters of the polynomial description of the process of river flow.

In chapter V the effectiveness of the recursive estimation algorithms have been investigated for real-time prediction of the flows of the river Teesta at Domohani Road Bridge near Jalpaiguri town during a short span storm period. In the design of large scale water resources systems needed to meet the rapid expansion of irrigation and hydropower generation the trend is towards more advanced engineering operation in terms of monitoring, security and control of river flows during a short span storm period. This requirement so necessary to provide a reliable decision methodology has placed greater demands on the quantity and quality of real-time prediction of river flows. The very accurate nature of the prediction of river flows by recursive estimation algorithm has demonstrated that the demands are adequately met. Further investigational efforts are needed to obtain real-time prediction with other versions of recursive estimation techniques, e.g., exponential weighting of past data and Kalman filtering techniques. From the work presented in this chapter it is claimed that on-line flood warning and control measures can be implemented provided adequate real-time information processors are installed at the gauging stations with closed loop decision regularisation for operation and control of hydraulic structures of the water resources systems.

In chapter VI recursive least square non-stationary time series analysis technique of cybernetics has been put to good use in on-line forecasting of daily flow of the river Teesta, a non-tidal river. A simple dynamic model is obtained when tested with field data. The model is shown to simulate adequately the major variations of flows observed in the field measurements. It is hoped that simulation model for on-line forecasting of river flow would help the designer and operator of the Teesta water resources system involving control, utilisation and disposition of the Teesta water.

Water is a basic resource. It is highly dynamic and it is to be utilised, controlled and disposed judiciously and in a planned manner so as to bring smile to the grim faced poverty stricken millions living in a paradox of scarcity and abundance of water.

The present investigation has planted the seedling for on-line and real-time operation of water resources systems and is addressed to the water resources engineers planning systems installation and manufacturing personnel providing necessary hard ware and soft ware support.