ABSTRACT

SYSTEM THEORETIC ANALYSIS FOR IDENTIFICATION, MODELLING AND PREDICTION OF SURFACE AND GROUND WATER HYDROLOGY

The research work carried out in this investigation is devoted to the field of technical cybernetics and to the area of computer-aided modelling of physical processes and systems. The area of the work encompasses identification, modelling and prediction of the hydrological characteristics of the River Rupnarayan in the deltaic West Bengal and the ground water hydrology of the Western Gujarat region. The investigation consists of four steps.

Step I: Cybernetics in identification, modelling and prediction of surface water hydrology of a tidal river: Group Method of Data Handling (GMDH) multilayer algorithm.

The multilayer GMDH is used to develop a mathematical model of optimum complexity of three hourly river flow at Buxi gauging station of River Rupnarayan. The method involves generation of different regression
polynomials by using all possible combinations of input variables and selection therefrom the best possible ones according to the criterion of minimum integral square error.

Step II : Cybernetics in identification, modelling and prediction of surface water hydrology of a tidal river : GMDH combinatorial algorithm.

The combinatorial GMDH is used to obtain the mathematical description of the flow pattern of the River Rupnarayan at Buxi gauge station on the basis of readings of the six up stream gauging stations of River Rupnarayan in the deltaic West Bengal.

Step III : On line simulation of three - hourly flows of a tidal river in a deltaic region with interacting state variables by recursive least square instrument variable algorithm.

The recursive least square instrument variable algorithm is used to obtain an on line monitoring technique for the three hourly flow of the river Rupnarayan at Buxi gauging station with interacting state variables of gauge readings at different up-stream gauge stations.
Step IV: Mapping of piezometric heads of ground water in the Narmada Mahi Doab by iterative electric potential method.

The aim of this work is to estimate the value of the piezometric head at an unmeasured point in the same aquifer and to estimate the slope of the piezometric head gradient. The measured piezometric heads obtained are used to draw isopiezometric lines with the help of Laplace type boundary problem of the electromagnetic field theory.