NETWORK ANALYSIS AND SIMULATION
IN
WATER SUPPLY SCHEMES

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CERTIFICATE

This is to certify that the thesis entitled "NETWORK ANALYSIS AND SIMULATION IN WATER SUPPLY SCHEMES" being submitted by Sudhir Kumar Gomasta, to the Indian Institute of Technology, Delhi for the award of the degree of DOCTOR OF PHILOSOPHY is a record of bonafide research work carried out by him under my guidance and supervision. In my opinion, the thesis has reached the requisite standard fulfilling the requirements of the regulation relating to the said degree. The material contained in this thesis has not been submitted in part or full, to any other university or institute for the award of any degree or diploma.

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ABSTRACT

The study covers three major aspects of water distribution system; namely, the network analysis, the optimisation of the network both under deterministic and under uncertain conditions and the short term forecasting of daily water use. The linear graph theory, a subject developed in analysing electrical networks is used in analysing water distribution networks. The method has many distinct advantages over the existing methods commonly used in such analyses. The methodology is first illustrated on a small hypothetical network and is subsequently applied on a moderately large network of a residential colony. The optimisation model is principally based on dynamic programming approach but suitably modified to include the special topological features of the water distribution networks. The model works on two distinct planes, viz., the 'parallel merge' and the 'serial merge' which is applied concurrently to analyse the parallel and series branching of a network. The looped networks are obtained after transforming them to a branch network using graph theory. The method is easy to implement and is explained through an illustrative example. The next part of the study is to systematically include various uncertainties inherent in the estimation of the values of economic, hydraulic and the population growth parameters in the optimisation analysis.

Nomograms have been prepared to obtain optimal pipe sizes under uncertain conditions. Lastly, an efficient day to day pumping operation of a water distribution requires a reliable 24 hours ahead forecast of water use. A simple dynamic on line ARMAX model which can be easily implemented on a microcomputer is applied on a daily water use series of an Indian city and the results discussed.

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