

Operational optimisation of water supply networks using a fuzzy system

Saulo de Tarso Marques Bezerra^{1*}, Simplicio Arnaud da Silva² and Heber Pimentel Gomes³

¹Department of Technology, Centre of Agreste Region, Federal University of Pernambuco, Caruaru, PE, Brazil

²Department of Electrical Engineering, Federal University of Paraíba, João Pessoa, PB, Brazil

³Laboratory of Power and Hydraulics Efficiency in Water Supply Systems, Department of Civil and Environmental Engineering, Federal University of Paraíba, João Pessoa, PB, Brazil

Abstract

This paper presents a fuzzy system to control the pressure in a water distribution network, by using valves and controlling the rotor speed of the pumping systems. The variable frequency drive tracks the minimum head of the pumping system, while the control valves have the function of eliminating the excess pressure at various points of the network. The control system can track any reference pressure value and there is no limit for the number of monitored points. Experiments were carried out to demonstrate the fuzzy system's efficiency. By extrapolating the results achieved in the experimental setup to a real hydraulic network with leakages and no pressure control, the volumetric losses could be reduced by more than 56%. The experiments showed that the system is robust enough to control the pressure of an experimental setup of water distribution. Besides, the proposed system can be easily applied to similar water supply systems and would help to reduce the consumption of water and electricity, as well as to reduce the maintenance costs.

Keywords: water, power efficiency, water supply system, fuzzy logic