

Leak Locating of Underground Water Supply Pipelines using Reinforcement Learning - DDPG

YOUNG-SUP LEE¹

¹DEPARTMENT OF EMBEDDED SYSTEMS ENGINEERING, INCHEON NATIONAL UNIVERSITY, Republic of Korea

A reliable leak locating system is one of crucial components for the effective management of underground water supply pipelines. In this study, a reinforcement learning based on deep deterministic policy gradient (RL-DDPG) is investigated for improved locating of leak point in those pipelines. Basically the exact leak locating depends upon the precision of the arrival time difference estimation between leak signals measured by sensors and the propagation speed of the leak-related elastic wave, the research on the estimation of time delay has been one of the key issues in leak locating. The arrival time difference was estimated with the peak time of cross correlation functions of the measured signals. Theoretical aspects of RL-DDPG is summarized at the beginning in this study. Apart from RL-DDPG, conventional approaches including the basic rectangular window, Roth window, Wiener window, SCOT window, PHAT window and maximum likelihood window, are considered to compare the accuracies of leak locating each other theoretically. Then the experimental set-up are described to assess the leak locating capability of the theory against an actual underground pipeline. The length of the pipeline is longer than the distance of 120 m between the two leak sensors used in the experiment. The experimental results showed better leak locating capability than other approaches such as simple correlation based one. The performances and differences between the RL-DDPG method and other approaches are discussed in detail in terms of the leak locating error ratio.