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Abstract

This dataset contains the pressure and flow measurements for a water network with leaks at different locations. The experimental setup consists of a reservoir supplying a $1.5kW$ pump. Water is pumped through a $25mm$ diameter pipe with a length of $65m$. Leaks are introduced at $15m$, $30m$ and $50m$ and three different leak sizes are tested at each location. The dataset contains the pressures and flow measurements at the inlet and outlet of the pipe. The dataset is primarily used to investigate the effect of noise and model error for the identification of leaks using model-based leak detection strategies.

Methods

Leaks were introduced into the network and the size of the leak was controlled by a valve. Pressure measurements at the inlet and outlet of the pipe were measured. The flow was measured at the inlet of the pipe. The leak size was measured, from which the outlet flow was calculated. All the measurements were converted to pressure in meter and flow in liter per second. The Hazen-Williams roughness coefficient of the pipe was calculated experimentally as 100. Each dataset contains 15 seconds of measurement taken at 10000 Hz.

Usage Notes

The dataset contains nine leak cases, namely:

'Leak 1_15m.npy',

'Leak 2_15m.npy',

'Leak 3_15m.npy',

'Leak 1_30m.npy',

'Leak 2_30m.npy',

'Leak 3_30m.npy',

'Leak 1_50m.npy',

'Leak 2_50m.npy',

'Leak 3_50m.npy'.

The measurements for each leak case are arranged as: $[P_1, Q_1, P_2, Q_2]$, and the dataset contains a python script called 'plot_data.py' which plots the data and calculates the mean leak location from the measurements

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Leak Detection Dataset

Experimental Setup

The dataset contains the pressure and flow measurements for different sizes of leaks at three locations. The experimental setup is shown in Figure 1. The experimental setup consists of a reservoir supplying a $1.5kW$ pump. Water is pumped through a $25mm$ diameter pipe with a length of $65m$. The pipe is instrumented with two pressure sensors (annotated by P_1 and P_2) and two flow sensors (annotated by Q_1 and Q_L). The outlet demand was calculated from the measured flows and was controlled by a valve.

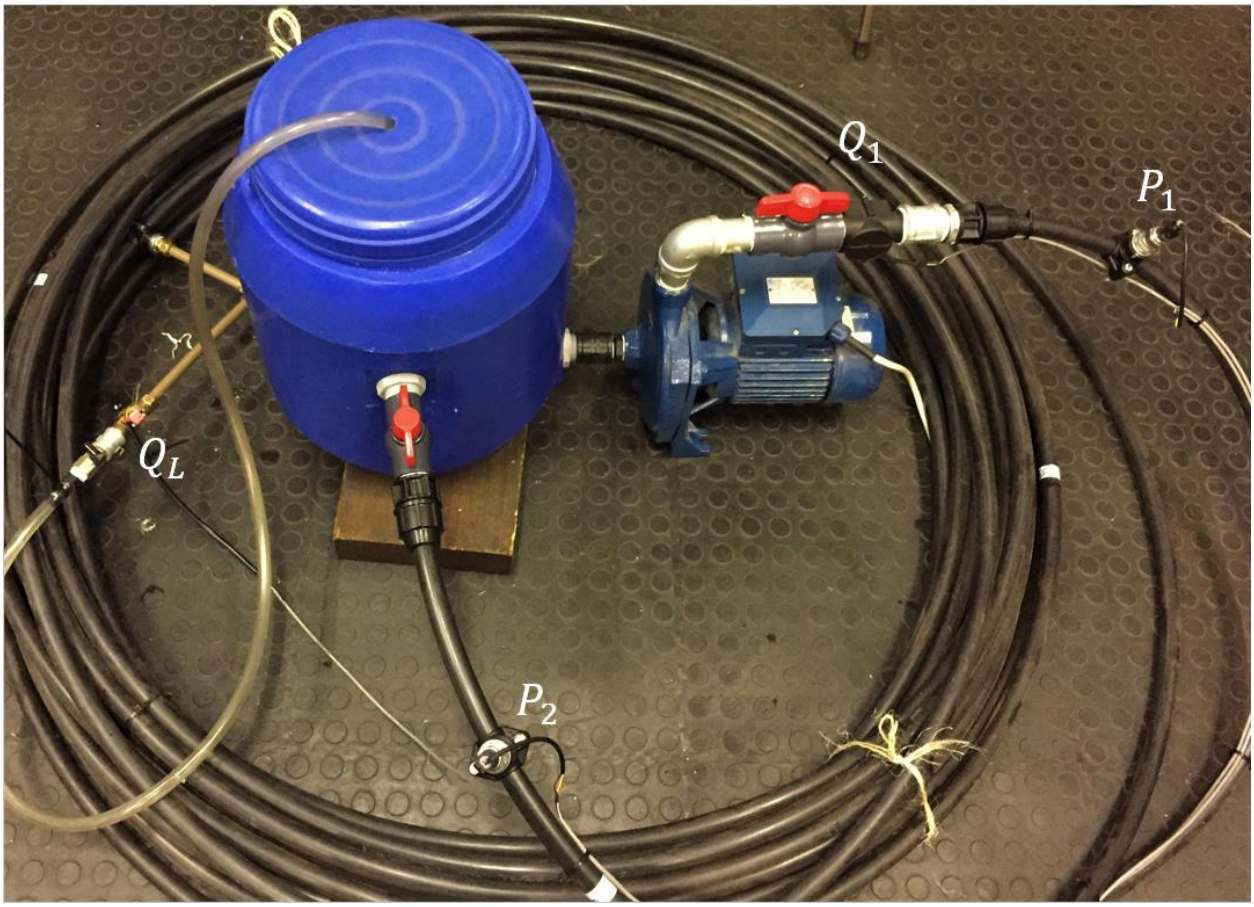

Figure 1 Photograph of the experimental setup consisting of a reservoir supplying a 1.5kW pump. Water is pumped through a 25mm diameter pipe with length of 65m. The pipe is instrumented with two pressure sensors and two flow sensors

An initial test was completed with no leaks to measure the actual Hazen-Williams roughness coefficient of the network. The Hazen-Williams roughness coefficient was calculated as 100.

Sensors Used

The pressure sensors, P_1 and P_2, had a full-scale error of 1.5% and could measure pressures between 0 and $5\ bar$. The flow sensor measuring the leak Q_L could measure flow between 1 and $25 l/min$ with an error raging up to 3%. The flow sensor measuring the flow Q_1 at the inlet could measure flow ranging between 1 and $120\ l/min$ with and error ranging up to 2%. Measurements were taken at 10000 Hz.

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Leak Cases

Nine leak cases were tested which were located at $15m$, $30m$ and $50m$. Three leak sizes were tested at each location ranging between $0.09l/s$ and $0.65l/s$. With the calculated Hazen-Williams roughness coefficient the model errors could be calculated which is shown in Table 1.

Table 1 Model Error for nine leak cases in %

Leak Location [m]	Leak Size [l/s]	Model Error in %		
		P_1	Q_1	P_2
15	**0.12**	0.62	5.09	0.55
	0.31	0.58	6.29	0.41
	0.65	0.56	4.78	0.41
30	**0.29**	0.89	4.91	1.05
	0.39	0.87	4.91	1.07
	0.60	0.87	4.95	1.02
50	**0.09**	0.90	4.91	0.76
	0.37	0.88	5.45	0.77
	0.60	0.87	4.78	0.77

Dataset

The datasets contain 15 seconds of measurements at a frequency of 10000Hz resulting in 150000 data samples for each case. The data files are given in a numpy format which are structured as P_1, Q_1, P_2 and Q_2. The dataset contains a Python script called Plot_data.py which plots the data. An example of the plotted measurements is shown in Figure 2. The script contains a function to calculate the leak location and the script prints the predicted leak size and location.

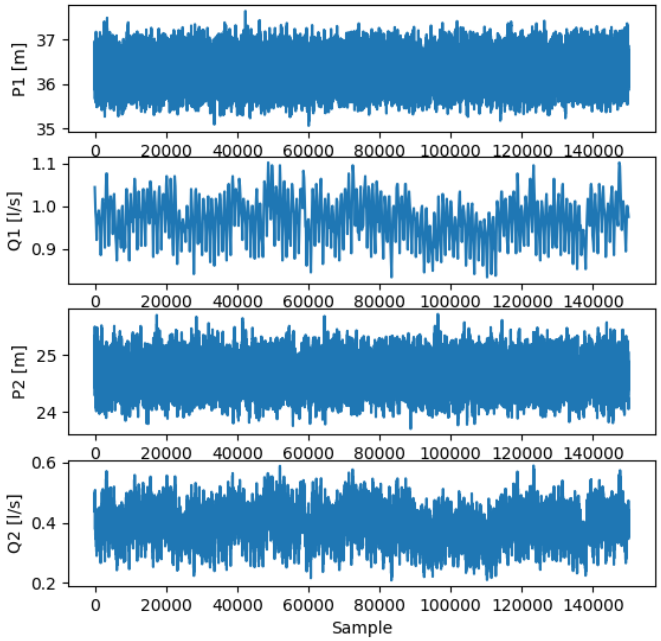

Figure 2 Example of the pressure and flow measurements