The title of the thesis of the master degree:

Determination of Valves Status of Pipeline Networks by Using Fluid Transients

The abstract of the thesis of the master degree:

Fluid transients have been widely used to assess the conditions of pipelines and to detect the anomalies within them such as leakages and blockages, where significant number of transients-based techniques are developed over time to determine the anomalies characteristics. However, the applications of these techniques have been limited to simple systems with single pipelines. Accordingly, the purpose of this research project is to expand the application of fluid transients to include complex systems with number of pipelines and loops which represents the scenario of water distribution systems (WDSs), however the process includes number of complications that need to be addressed. The research project introduces a methodology to determine valve configurations within a pipeline network by using fluid transients. The research project consists of four aims which are constructing a pressure trace filter to process the noise in the pressure trace, developing a method for estimating the uncertain fluid transient wave speed, determining valve configurations based on the delay duration of the fluid transient and identifying the causes of the transients secondary reflections and exploring the possibility of modeling them. The laboratory data which is required for the research project aims is obtained by using the 3-Inch Copper Pipeline Network which is installed at Robin Hydraulic Laboratory in the school of civil, environmental and mining engineering at the University of Adelaide.

There are four main outcomes for the research project which represents the achievement of the four aims. For Aim One, it is found that the conversion of the pressure trace into slope trace is significantly efficient in denoising the pressure trace and determining the transient arrival time accurately. For Aim Two, it is determined that there are number of the uncertainty parameters in the theoretical expression of the transient wave speed including pipeline diameter and Young's modulus of elasticity. Accordingly, they are combined in one parameter called theta and its value is optimized by using the Genetic Algorithm (GA) which enables the determination of theoretical transient travel times that match the measured values. For Aim Three, it is found that each valve in the pipeline network causes a unique transient delay duration when it is close. Accordingly, the delay duration is used to detect and identify any closed valve in the pipeline network. For Aim Four, it is determined that there are number causes for transients secondary reflections and that the reflections can be modeled which has number of useful applications.