Leakage Detection in Galvanized Iron Pipelines Using Ensemble Empirical Mode Decomposition Analysis

Makeen Amin and M. Fairusham Ghazali

Fakulti Kejuruteraan Mekanikal, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia

Abstract. There are many numbers of possible approaches to detect leaks. Some leaks are simply noticeable when the liquids or water appears on the surface. However many leaks do not find their way to the surface and the existence has to be check by analysis of fluid flow in the pipeline. The first step is to determine the approximate position of leak. This can be done by isolate the sections of the mains in turn and noting which section causes a drop in the flow. Next approach is by using sensor to locate leaks. This approach are involves strain gauge pressure transducers and piezoelectric sensor. the occurrence of leaks and know its exact location in the pipeline by using specific method which are Acoustic leak detection method and transient method. The objective is to utilize the signal processing technique in order to analyse leaking in the pipeline. With this, an EEMD method will be applied as the analysis method to collect and analyse the data.

Keywords: Waves propagation; transient signal; ensemble emperical mode decomposition.
PACS: 07.07.Df

INTRODUCTION

Water is an important crop for human beings to live. The world scenario nowadays, water is a global issue. The World Water Vision Report, 2000 acknowledge that there is a global water crisis. The crisis is not about having too little water to satisfy our needs but it is a crisis of water management so badly for billions of people in the world and other words "suffer badlly". The lack of water services is one of the most important physical signs of extreme poverty. As estimated in Global Water Supply and Sanitation Assessment 2000 Report by World Health Organisation (WHO) and United Nations Children' Fund (UNICEF) [1], 780 million people had no access to improved water supply and 2.5 billion were without access to improved sanitation. If current trends continue, these numbers will remain unacceptably high in 2015, 605 million people will be without an improved drinking water source and 2.4 billion people will lack access to improved sanitation facilities.

Currently, over 1.4 billion people live near water resources where the use of water already exceeds minimum recharge level resulting depletion of ground water [2]. As time goes, every generation tries to improve the previous system and existing.

Pipe leaking can be happen in many forms such as burst, hole and cracks. In global world water loss or water leaking can vary between 10 to 40% of total water volume produced, which can be great economic importance [1]. In Malaysia, there had been recorded 21.90% of physical and 14.70% of commercial water loses in year 2009.

WATER HAMMER PHENOMENON

Water hammer phenomenon also known as hydraulic transient usually occur at fast flow changes in pressurized water pipelines [3]. This phenomenon can be considered problem event in water pipeline. This is because water hammer usually occurs and creates damage to the pipeline due to strong pressure peaks and fatigue.

Water hammer phenomenon often brought strong vibration on the pipeline. Therefore, the calculation of water hammer is important especially in designing at operates pressurized piping system [4]. When a change happen in water velocity occurs, it will resulted rise and drop of pressure happen in the pipeline. Water hammer propagates as elastic wave along the pipes. Water phenomenon can be induced both in one-phase and two-phase system during pipeline transients [5]. In one-phase system, fluid flow in the channel is described with the mass, momentum and energy balance equations. In two-phase system, both velocity and thermal equilibrium in case of two–phase flow. In this system, friction and vapour condensation plays important roles to induced water phenomenon.

International Conference on Mathematics, Engineering and Industrial Applications 2014 (ICoMEIA 2014)
AIP Conf. Proc. 1660, 070003-1–070003-5; doi: 10.1063/1.4915721