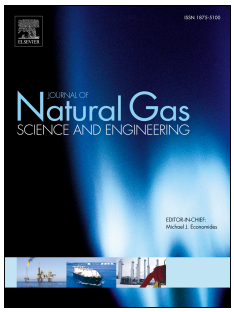
Accepted Manuscript



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PII: S1875-5100(17)30214-7

DOI: 10.1016/j.jngse.2017.05.006

Reference: JNGSE 2175

To appear in: *Journal of Natural Gas Science and Engineering*

Received Date: 24 November 2016

Revised Date: 3 May 2017

Accepted Date: 4 May 2017

Please cite this article as: Zakaria, Z., Idroas, M., Samsuri, A., Adam, A.A., Ultrasonic instrumentation system for Liquefied Petroleum Gas level monitoring, *Journal of Natural Gas Science & Engineering* (2017), doi: 10.1016/j.jngse.2017.05.006.

Ultrasonic Instrumentation System for Liquefied Petroleum Gas Level Monitoring

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Abstract: Liquefied Petroleum Gas (LPG) is commonly stored in a highly pressurized cylinder tank, where its liquid level needs to be measured accurately for a safety reason. Currently, the level of LPG is measured using a weighing scale. This approach has been constructed to facilitate the process of LPG level measurement inside a cylinder tank. In this research, a new method is developed by using a non-invasive ultrasonic instrumentation system for monitoring LPG level in a 14 kilogram cylinder. The instrumentation system was integrated with the designed experimental rig. Module ultrasonic sensors Truma.LC-V1.15 were attached vertically outside of the cylinder wall on a sensor holder of the experimental rig. The ultrasonic sensors emit the ultrasonic signals and the signals will then propagate through the cylinder wall. The reflected signal was recorded again by the ultrasonic sensors. The reflection of the ultrasonic signal depends on the type of the medium's impedance. The generated signals from the transceiver type of sensors were sent to the Pico Scope Data Acquisition System (DAQ) for data reading. The output voltage signals were processed by the computational data process system, giving a result of the LPG liquid level inside the cylinder. An image of the liquid level in the cylinder was constructed using javascript based programming. The image showed the liquid level in percentage value and a html software was used as the interface in this program. The developed instrumentation system was able to detect the level of LPG in the cylinder.

Keyword: liquefied petroleum gas; ultrasonic; level monitoring; non-invasive; lamb wave.

1 Introduction

Liquefied Petroleum Gas (LPG) becomes the most popular source of energy fuel for household and commercial uses, as well as industrial sector. Basically, when compared to other liquid fuels, LPG is more flexible to handle and having lesser pollution with minimum space used for storage. LPG consumption for every customer was different depending on the rate of use. The different on LPG consumption rate of consumers carries variation of usage among consumer thus requiring friendly LPG cylinder information measurement for monitoring. Most of the LPG users, especially commercial and industrial sectors, used weighing and mechanical instruments to determine the exact contents of LPG inside the cylinder (Priya et. al., 2014). Additionally, some of them measured the amounts of LPG by checking the content pressure. However, some of the mechanical instruments operation needs to discharge the LPG to atmosphere. It might be exposed into a dangerous situation either explosion or cold burn (Zakaria and Mustafa, 2013). A new system is therefore needed to accurately measure the level of LPG inside the storage in more appropriate and safe manner.

Level measuring instrument has been widely used in industrial and commercial fields. Determination of type of sensor is important to validate the rate of efficiency of the measurement. The efficiency rate is highly dependent on physical and application variables that affect the selection (Morris and Langari, 2012). The selection criteria include the substance physical phase, temperature, pressure, chemistry, specific gravity of medium,