

Studies on Attenuation in Ultrasonic Flow Meter

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Abstract

Ultrasonic technology is used for various crucial measurements in the industry; few of the most popular uses are in Non-destructive testing, flow measurement, level measurement etc. Like every other energy waveform the ultrasonic waveforms also suffers attenuation while travelling through a medium. This attenuation is a function of the square of resonant frequency of the ultrasonic waveform, thermal coefficient of the medium, bulk and shear viscosity of the medium. If the attenuation is high the received signal becomes almost undetectable, hence transducer frequency is a very important criterion for choice of ultrasonic transducer to be used in desired medium.

In order to design an in-house ultrasonic flowmeter, it was necessary to determine the transducer frequency for the given flow medium and pipeline dimension. For this purpose, a model was prepared using CFD Module and Acoustic Module of COMSOL®. In order to achieve coupling between the flow and acoustic, thermoviscous acoustic transient interface have been used. This interface aided in studying the effects of attenuation due to frequency of waveform, the thermal co-efficient of medium and bulk viscosity of the medium.

The model was executed with water as the medium and amount of attenuation was studies at various transducer frequencies. Further, studies were done with water as medium at different flow rates. The results obtained with these simulations were used to arrive at an acceptable value of transducer frequency to be used in ultrasonic flowmeter prototype for a given pipe line size.

Studies done till now are for ultrasonic flowmeter with water as a medium, however the same approach can be effectively used to do attenuation studies for other mediums too. The model for Non-destructive testing and level measurement can also be made on similar lines.