

Prediction of Two-Phase Flow Patterns Using Machine Learning Algorithms

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Abstract – Predicting the two-phase flow pattern prediction is important to many industries such as power generation and oil and gas; for example, knowing the type of flow pattern is crucial for an accurate calculation of the pressure on the system. The transient nature of two-phase flows makes analyzing and predicting the flow pattern for a normal straight pipe a very complex procedure. The situation becomes more complex when a piping component is disturbing the fully developed flow in a straight pipe. In this work, the flow pattern downstream of an orifice was experimentally investigated for an intermittent flow pattern at orifice-to pipe area ratios of 0.14, 0.25 and 0.56. The flow pattern downstream of the orifice was identified using a probability density function (PDF) of the time signal void fraction as well as identified using a high-speed imaging system. All tests were presented by the calculated superficial velocity of the mixture based on the area of the orifice being used and the volumetric quality. The predicted flow pattern was identified using a Machine Learning Algorithm known as the Classification Learner environment in MATLAB. This method was able to predict the flow pattern downstream of the orifice with a total error of $\pm 9\%$.

Keywords: Two-phase flow, Flow pattern, Orifice, Machine learning.