# Multiphase flow estimation using accelerometers, ultrasonic sensors, and machine learning

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**Introduction and background:**

Over the past few decades, the proper measurement of multiphase flow has been evident and subjected to a lot of research to better understand the different parameters of multiphase flows. Traditionally, the different phases of the multiphase flow are separated and processed separately to monitor the flow. In order to minimize the limitations of traditional methods, researchers have been for developing new methodologies and are using modern software and tools to measure the multiphase flow. At present, machine learning has proved to be the most promising method for multiphase flow measurement. As machine learning continues to advance, its abilities for handling large complex data have increased significantly.

It is vital that any industry measures different parameters and monitors the results properly to ensure smooth operation. Particularly, in the oil and gas industry, an accurate measurement of flow rate and flow type plays a huge role in improving production. The raw fluid contains a mixture of oil, gas, water, sand, and other additives that are present in the well. So, it is necessary to know the content of each fluid at different stages of production.

### Problem description and objective:

The main aim of this thesis is to estimate multiphase flow parameters from the accelerometer and ultrasonic sensor data, using machine learning. At first, the new accelerometers and ultrasonic sensors were installed in the existing multiphase test rig in the process hall of campus Porsgrunn of USN. Then, a series of experiments were conducted, and data were recorded using two new data acquisition systems. The raw data were processed, and useful features were extracted from the collected measurements. Various machine learning techniques were used to predict the flow regimes and flow rates of different fluids based on the processed data.

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