5

ADAPTIVE THRESHOLDS FOR LEAK MONITORING

This chapter detailed leak detection in a gas mixture pipeline using adaptive thresholds. Before leak detection, OLGA modelling and simulation are validated against simulation and experimental data. Validation is performed using mass flow rate and pressure measurements. For comparison, data sets from case studies are also presented during normal and leakage conditions. Then, model predictions of pipeline outlet mass flow under normal and leaking conditions are shown. The transition from constant to adaptive thresholds for leak detection is highlighted with an example. Finally, leak detection performance measures are discussed for all the cases.

OLGA Software Validation

Simulations, as well as experiments, are used to validate the OLGA model.

Validation using a Simulation

A pipeline model by Uilhoorn [90] for a 150 km horizontal pipeline transporting natural gas was taken as a benchmark. The natural gas used in this book had a composition of 84.385% methane, 8.871% ethane, 3.179% propane, 1.919% carbon dioxide, 0.658% n-butane, 0.416%

nitrogen, 0.346% i-butane, 0.091% n-pentane, 0.0897% i-pentane, 0.0317% hexane, 0.0073% heptane, 0.0020% hydrogen, 0.0016% octane, and 0.0010% oxygen. The mass flow rate at the pipeline outlet varied with time, as shown in Figure 5.1, as was also done in the study by Uilhoorn [90]. Figure 5.1 shows that the same pattern is followed at each node on the pipeline. The validation of the transient OLGA model of the current work is presented in Figure 5.2. The mass flow rate values 120 km away from the inlet are considered for the model validation. It can be observed that the OLGA model's results closely matched the simulation results from the model by Uilhoorn [90] with the root mean square error (RMSE) of 5.42 kg/s, i.e., 0.75%. This small difference is due to the variation of solvers and discretization schemes applied in OLGA and the benchmark case.

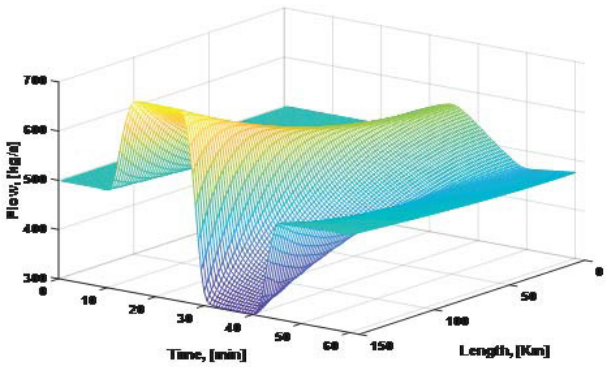

Figure 5.1 Mass flow rate profile in the natural gas pipeline with respect to time and length using OLGA

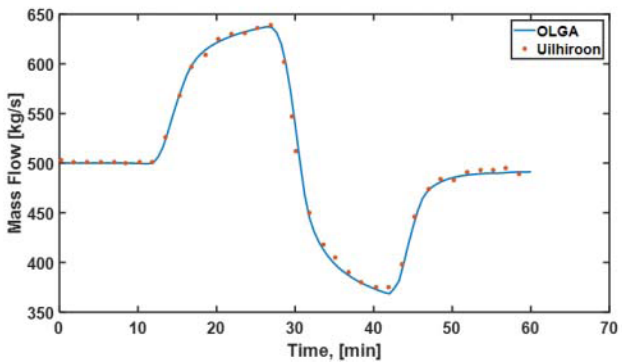

Figure 5.2 Comparison between the mass flow rates from the OLGA model and the benchmark [90]