Summary

Thesis Title: *Speed of Sound Measurements of liquid methane at cryogenic temperature*

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This thesis reports speed of sound experimental measurements in liquid methane (CH_4) along five isotherms, in the temperature range of (130 and 162) K, and for pressures up to 10 MPa. A dedicated experimental apparatus, custom-designed for accurate speed of sound measurement at cryogenic temperatures and high pressures, has been developed and the double pulse-echo technique has been adopted. In order to characterize this new apparatus and its performance, experimental results have been compared with speed of sound values of liquid methane available in literature. A further comparison has been made between the experimental measurements and the speed of sound values obtained using the reference equation of state of methane of Setzmann and Wagner, as well as the GERG-2008 model. The relative expanded uncertainty (k=2) associated to the obtained results is in the order of 0.4 %, mainly influenced by the repeatability of the measurements. Finally, density measurements of two different multi-component LNG mixtures along four isotherms (100, 120, 140 and 160) K and for pressures up to 10 MPa have been reported. Then, the obtained results, with an uncertainty of about 0.04 %, have been compared with the predicted values, calculated by using four different equations of state: the COSTALD3 equation of state, the ERKM equation of state, the GERG-2008 model, and the EOS-LNG model.