Simultaneous integration of geophysical and production data for hydrocarbon reservoir modeling and characterization

PHD PROGRAMME IN PETROLEUM ENGINEERING

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1. Challenge
The conventional geo-modeling workflow uses available information such as: historical production data, geophysical data, and well-log data; individually. Integrate all the available data in a unique workflow is still one big challenge for the oil and gas industry.

Figure 1: Traditional modeling methodology versus proposed methodology

2. Methodology
The proposed methodology aims to achieve one solution – the same petrophysical property models – which minimizes simultaneously the objective functions of both methods: seismic inversion and history matching. This proposed algorithm can be summarized in the following methodological sequence:

1) In a first step, the models of subsurface petrophysical properties are obtained with seismic inversion (geostatistical seismic inversion). An average image of petrophysical properties is retained for the next step;

2) In a second step, to integrate the dynamic data into petrophysical properties model, a geostatistical history matching is proposed, conditioned to well data and the average model obtained from the seismic inversion.

3. Workflow

Figure 2: Proposed algorithm – simultaneous integration of geophysical and production data in hydrocarbon reservoir modeling

4. Results
Seismic Inversion Evolution (top) and History Matching Evolution (bottom)

5. Conclusions
This method is able to integrate seismic information into history matching workflow: The final models have geological consistence, reproduce histograms, honour the experimental data (well log and production data), and reproduce the seismic data; Uncertainty coming from seismic inversion and history matching is taken into account.

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7. References