RESERVOIR CHARACTERIZATION USING SEISMIC AND WELL LOG DATA

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Doctor of Philosophy

by

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Chapter 7

Conclusions, Study Limitations and Suggestions for Future Work

7.1 Conclusions

In the present research work, the F3 block and Penobscot 3D seismic datasets have been used for rigorous analysis by application of state-of-art standard inversion techniques. Following important conclusions may be drawn from the present research work:

1. The results show that although MBI, CI, MLSSI and BLI methods have provided good results by distinctly demarcating the low-impedance zone corresponding to the target reservoir, MBI method has yielded the best results.

2. Pre-stack inversion to measure the Z_P, Z_S, V_P and V_S for both raw and conditioned gather, LMR $(\lambda\rho, \mu\rho)$ attributes and V_P/V_S ratio reveal that that inverted conditioned gather provided better results in comparison to the inverted raw gathers. This highlights the importance of data conditioning in estimating the petrophysical parameters.

3. The pre-stack data analysis using simultaneous inversion method has yielded the primary information on the absence of any significant reservoir In the Penobscot study region.

4. The elastic impedance inversion results applied to pre-stack data for near and far angle stacks have confirmed the absence of any reservoir in the pre-stack data.

5. The S/N ratio has been found to increase by proper stacking of data. Also, the far angle stack derived elastic impedance has provided better results in comparison to the near angle stack data derived elastic impedance.

6. The elastic impedance and acoustic impedance have revealed a close match.

7. A comparison of correlation coefficients between actual and predicted petrophysical properties by use of geo-statistical techniques reveal the usefulness of these techniques in predicting the petrophysical properties of the rock mass. Although PNN technique appears to be the most accurate technique in comparison to other contemporary techniques, the MLFN seems to also closely follow PNN with slight variations only.

8. The low impedance, high porosity, low density, low velocity, and high gamma ray values derived from post-stack and geostatistical techniques suggest the presence of an anomalous zone between 1680ms to 1700ms time interval for post-stack data. This time interval zone is equivalent to 1680m of the depth of occurrence of the reservoir from the ground surface.

9. As evident from post-stack results, the reservoir exists from inlines 200-300 and from crosslines 630-880. The horizontal extent of the reservoir in inline and crossline directions may be estimated as 3687m and 4445m, respectively.

7.2 Limitations of present work and suggestions for future work

1. As already mentioned in the methodology section, due to the non-availability of data from Indian oil fields and any records from the regulatory bodies on hydrocarbons in India, the research work has been done only one the data available from the F3 block, the Netherlands and Penobscot region, Canada oil fields.

2. In the F3 block, the Netherlands data, only post-stack was accessible and pre-stack was not available. Similarly, from the Penobscot field, Canada, only the pre-stack seismic was available while the post-stack data was not available. Therefore, a comparative result analysis of pre-and post-stack data in the respective oil fields could not be undertaken.

3. In future work, a genetic algorithm (GA) could be used for post-stack seismic data analysis and its interpretation could be extended to pre-stack interpretation also. Further, the Linear Programming Sparse Spike Inversion method can also be implemented on post-stack data.

4. Till now, there are no precise quality control methods for matching the events on PP and PS seismic sections in-depth domain. Cross-correlation between the pseudo seismic data and seismic data could be one way to gain better control over the event matching in future studies.

5. The use of Radial Basis Function Neural Network (RBFNN) could also be useful to estimate petrophysical parameters for post-stack data.

6. A number of recent techniques using full waveform inversion (FWI) are gaining popularity. In this light, the findings of the present work may be used to provide a sound base for proper understanding of the FWI with due regard to cost and time benefits. This may be investigated by the reseachers in the future work.