

Table of Contents

- Preface p. xi
- 1 Introduction to rock physics p. 1
 - 1.1 Introduction p. 1
 - 1.2 Velocity-porosity relations for mapping porosity and facies p. 2
 - 1.3 Fluid substitution analysis p. 15
 - 1.4 Pressure effects on velocity p. 24
 - 1.5 The special role of shear wave information p. 30
 - 1.6 Rock physics "What ifs?": fluid and lithology substitution p. 42
 - 1.7 All models are wrong...some are useful p. 43
- 2 Rock physics interpretation of texture, lithology and compaction p. 48
 - 2.1 Introduction p. 48
 - 2.2 The link between rock physics properties and sedimentary microstructure: theory and models p. 51
 - 2.3 Example: rock physics interpretation of microstructure in North Sea turbidite systems p. 70
 - 2.4 Relating rock physics to lithofacies and depositional environments p. 81
 - 2.5 Example: seismic lithofacies in a North Sea turbidite system p. 83
 - 2.6 Rock physics depth trends p. 90
 - 2.7 Example: rock physics depth trends and anomalies in a North Sea field p. 96
 - 2.8 Rock physics templates: a tool for lithology and fluid prediction p. 101
 - 2.9 Discussion p. 107
 - 2.10 Conclusions p. 109
- 3 Statistical rock physics: Combining rock physics, information theory, and statistics to reduce uncertainty p. 111
 - 3.1 Introduction p. 111
 - 3.2 Why quantify uncertainty? p. 112
 - 3.3 Statistical rock physics workflow p. 123
 - 3.4 Information entropy: some simple examples p. 132
 - 3.5 More Carlo simulation p. 136
 - 3.6 Statistical classification and pattern recognition p. 138
 - 3.7 Discussion and summary p. 165
- 4 Common techniques for Quantitative seismic interpretation p. 168
 - 4.1 Introduction p. 168
 - 4.2 Qualitative seismic amplitude interpretation p. 168
 - 4.3 AVO analysis p. 180
 - 4.4 Impedance inversion p. 230
 - 4.5 Forward seismic modeling p. 252
 - 4.6 Future directions in quantitative seismic interpretation p. 256
- 5 Case studies: Lithology and pore-fluid prediction from seismic data p. 258
 - 5.1 Case 1: Seismic reservoir mapping from 3D AVO in a North Sea turbidite system p. 258
 - 5.2 Case 2: Mapping lithofacies and pore-fluid probabilities in a North Sea reservoir using seismic impedance inversions and statistical rock physics p. 278

- 5.3 Case 3: Seismic lithology prediction and reservoir delineation using statistical AVO in the Grane field, North Sea p. 295
- 5.4 Case 4: AVO depth trends for lithology and pore fluid classification in unconsolidated deep-water systems, offshore West Africa p. 306
- 5.5 Case 5: Seismic reservoir mapping using rock physics templates. Example from a North Sea turbidite system p. 312
- 6 Workflows and Guidelines p. 317
- 6.1 AVO reconnaissance p. 318
- 6.2 Rock physics What if so and AVO feasibility studies p. 320
- 6.3 RPT analysis p. 322
- 6.4 AVO classification constrained by rock physics depth trends p. 323
- 6.5 Seismic reservoir characterization constrained by lithofacies analysis and statistical rock physics p. 325
- 6.6 Why and when should we do quantitative seismic interpretation? p. 328
- 7 Hands-on p. 332
- 7.1 Introduction p. 332
- 7.2 Problems p. 332
- 7.3 Project p. 336
- References p. 340
- Index p. 356