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APPENDICES

Appendix A Well Trajectory Calculation Methods

A.1 Methods for well trajectory calculation

1. The average angle method
2. The balanced tangential method
3. The radius of curvature method
4. The minimum of curvature method
5. The tangential method

In this research well trajectory is calculated by the balanced tangential method

A.1.1 The balanced tangential method

$$\Delta North = \frac{\Delta MD}{2}|\sin(\alpha_1) \times \cos(\Phi_1) + \sin(\alpha_2) \times \cos(\Phi_2)| \quad \text{(A.1)}$$

$$\Delta East = \frac{\Delta MD}{2}|\sin(\alpha_1) \times \sin(\Phi_1) + \sin(\alpha_2) \times \sin(\Phi_2)| \quad \text{(A.2)}$$

$$\Delta Vertical = \frac{\Delta MD}{2}|\cos(\alpha_1) + \cos(\alpha_2)| \quad \text{(A.3)}$$

Appendix B R and R_{turn} Calculation

$$R = \left(\frac{\Delta MD}{\alpha_1 - \alpha_2}\right) \times \frac{\pi}{180} \quad \text{(B.1)}$$

$$R_\Phi = \frac{\Delta East}{(\cos(\Phi_1) - \cos(\Phi_2))} = \frac{\Delta North}{(\sin(\Phi_1) - \sin(\Phi_2))} \quad \text{(B.2)}$$

Appendix C Well Trajectories Data of Wells A and B

The details of survey files are shown in Table C1 and C2.

Table C.1 Well A Trajectories

MD (ft.)	Inclination (°)	Azimuth Grid (°)
0.00	0.00	0.00
65.62	0.00	100.12
131.23	0.00	100.13
196.85	0.00	100.14
262.47	0.00	100.15
328.08	0.00	100.16
390.06	0.07	100.17
454.82	0.28	100.18
513.78	2.39	100.40
575.07	5.85	103.16
637.20	8.86	102.65
695.70	11.81	102.48

Table C.1 Well A Trajectories (Con't.)

MD (ft.)	Inclination (°)	Azimuth Grid (°)
763.42	15.80	102.58
822.34	20.27	103.16
885.70	24.76	103.95
948.82	27.75	103.80
1011.71	30.36	102.49
1074.48	33.08	102.87
1137.57	36.47	102.86
1200.33	40.03	102.84
1263.42	42.71	102.47
1325.66	45.35	101.92
1389.30	47.66	100.57
1451.74	50.16	100.02
1515.35	52.30	99.62

Table C.1 Well A Trajectories (Con't.)

MD (ft.)	Inclination (°)	Azimuth Grid (°)
1575.92	55.11	99.14
1642.81	58.60	97.86
1704.36	61.22	97.23
1765.58	63.64	96.87
1827.92	64.73	94.59
1891.24	65.46	91.89
1953.77	67.55	89.90
2016.21	69.80	88.54
2079.10	71.10	86.76
2142.65	72.46	84.81
2198.85	74.24	82.89
2268.54	75.83	80.27
2331.59	75.67	77.34

Table C.1 Well A Trajectories (Con't.)

MD (ft.)	Inclination (°)	Azimuth Grid (°)
2393.96	74.49	74.57
2457.32	73.53	71.96
2520.83	72.85	69.19
2612.83	72.55	67.02
2677.66	74.41	66.72
2741.27	76.01	66.52
2804.07	76.41	66.48
2864.60	76.34	66.75
2905.54	76.05	66.48
2961.42	74.88	65.68
2968.60	74.73	65.58
3031.79	75.09	64.19
3094.55	71.63	61.58

Table C.1 Well A Trajectories (Con't.)

MD (ft.)	Inclination (°)	Azimuth Grid (°)
3157.78	68.53	58.49
3220.57	65.90	56.42
3283.69	64.35	53.98
3347.70	62.91	52.80
3409.78	62.30	51.27
3473.26	62.84	49.52
3536.55	62.72	47.67
3599.64	61.53	45.38
3686.02	61.91	41.55
3747.83	61.71	40.54
3811.12	61.52	37.07
3873.85	61.42	35.94
3936.68	61.37	35.98

Table C.1 Well A Trajectories (Con't.)

MD (ft.)	Inclination (°)	Azimuth Grid (°)
3998.98	60.96	35.94
4062.73	59.53	36.33
4125.82	59.61	36.38
4188.29	59.47	36.89
4251.35	59.25	36.56
4314.67	58.89	37.01
4374.80	59.03	36.89
4439.76	58.84	37.07
4502.89	58.82	37.20
4564.96	58.96	37.71
4628.58	58.74	37.86
4691.08	58.72	38.27
4756.20	58.78	38.25

Table C.1 Well A Trajectories (Con't.)

MD (ft.)	Inclination (°)	Azimuth Grid (°)
4816.67	58.67	38.79
4850.66	58.63	38.85
4943.27	58.40	39.07
5008.43	57.12	39.33
5070.70	55.64	39.44
5131.99	55.27	39.20
5194.88	55.41	39.52
5257.45	54.10	40.05
5308.21	54.06	40.41
5320.18	54.05	40.49
5381.40	54.32	40.61

Table C.2 Well B Trajectories

MD (ft.)	Inclination (°)	Azimuth Grid (°)
0.00	0.00	300.00
19.69	0.13	339.34
150.92	1.00	339.34
216.54	1.44	339.34
393.70	2.62	339.34
425.33	2.83	339.34
486.43	8.99	332.45
548.98	14.40	326.19
609.97	17.80	317.42
672.08	19.61	307.06
733.34	23.55	302.23
794.80	27.28	297.03

Table C.2 Well B Trajectories (Con't.)

MD (ft.)	Inclination (°)	Azimuth Grid (°)
858.01	31.91	293.43
919.02	35.59	289.20
991.33	39.34	287.19
1052.96	41.43	285.58
1115.16	44.72	283.41
1178.50	47.91	280.39
1237.37	51.00	277.97
1298.52	53.09	276.54
1362.67	54.74	275.44
1426.42	56.14	275.34
1488.94	55.12	275.72
1553.42	56.15	275.54
1614.09	57.91	274.93

Table C.2 Well B Trajectories (Con't.)

MD (ft.)	Inclination (°)	Azimuth Grid (°)
1627.26	57.89	275.02
1697.83	57.77	275.47
1712.80	57.75	275.56
1774.11	57.55	274.67
1835.96	57.45	274.31
1896.46	55.16	274.62
1959.35	53.35	275.35
2020.70	51.45	277.76
2083.86	48.72	280.11
2147.34	45.08	282.33
2211.88	41.13	284.13
2273.39	39.75	284.02
2337.20	40.19	284.23

Table C.2 Well B Trajectories (Con't.)

MD (ft.)	Inclination (°)	Azimuth Grid (°)
2399.54	40.25	287.21
2461.35	38.76	286.95
2528.64	39.53	285.98
2586.68	40.10	285.08
2652.03	40.84	284.79
2714.70	41.31	284.85
2778.31	39.77	285.73
2842.45	39.82	285.49
2905.38	39.76	285.72
2970.05	40.16	286.16
3032.28	38.87	283.83
3095.87	38.93	283.96
3159.12	38.90	283.67

Table C.2 Well B Trajectories (Con't.)

MD (ft.)	Inclination (°)	Azimuth Grid (°)
3222.93	38.83	283.35
3285.27	39.05	282.95
3350.00	39.19	283.00
3411.55	39.22	283.31
3472.77	39.30	283.84
3478.81	39.31	283.89

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