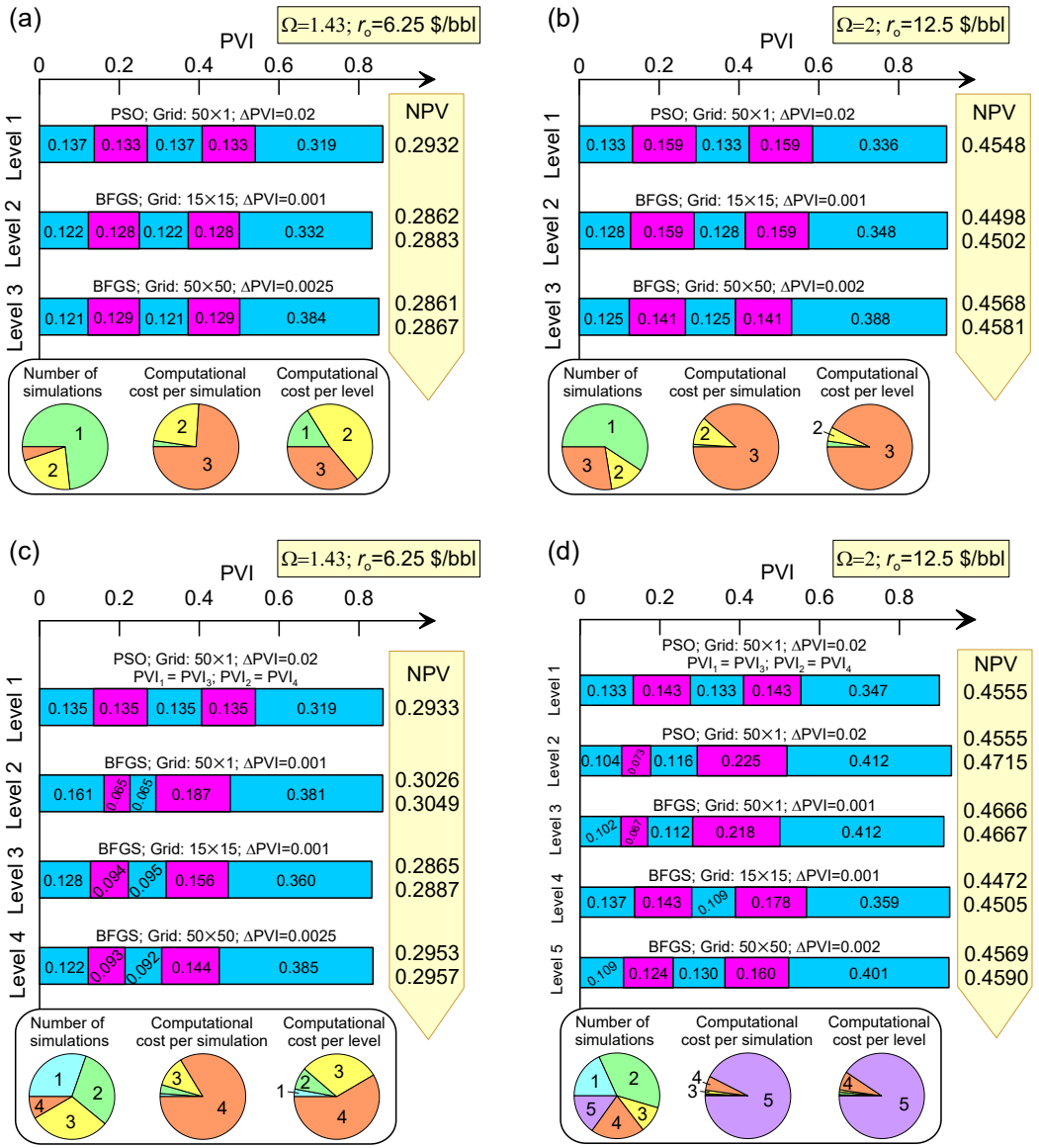
(a)
Ω=1.43; r_o=6.25 $/bbl
PVI
0
0.2
0.4
0.6
0.8
Level 1
PSO; Grid: 50×1; ΔPVI=0.02
0.137
0.133
0.137
0.133
0.319
NPV
0.2932
Level 2
BFGS; Grid: 15×15; ΔPVI=0.001
0.122
0.128
0.122
0.128
0.332
0.2862
0.2883
Level 3
BFGS; Grid: 50×50; ΔPVI=0.0025
0.121
0.129
0.121
0.129
0.384
0.2861
0.2867
Number of simulations
Computational cost per simulation
Computational cost per level
(b)
Ω=2; r_o=12.5 $/bbl
PVI
0
0.2
0.4
0.6
0.8
Level 1
PSO; Grid: 50×1; ΔPVI=0.02
0.133
0.159
0.133
0.159
0.336
NPV
0.4548
Level 2
BFGS; Grid: 15×15; ΔPVI=0.001
0.128
0.159
0.128
0.159
0.348
0.4498
0.4502
Level 3
BFGS; Grid: 50×50; ΔPVI=0.002
0.125
0.141
0.125
0.141
0.388
0.4568
0.4581
Number of simulations
Computational cost per simulation
Computational cost per level
(c)
Ω=1.43; r_o=6.25 $/bbl
PVI
0
0.2
0.4
0.6
0.8
Level 1
PSO; Grid: 50×1; ΔPVI=0.02
PVI1 = PVI3; PVI2 = PVI4
0.135
0.135
0.135
0.135
0.319
NPV
0.2933
Level 2
BFGS; Grid: 50×1; ΔPVI=0.001
0.161
0.065
0.065
0.187
0.381
0.3026
0.3049
Level 3
BFGS; Grid: 15×15; ΔPVI=0.001
0.128
0.094
0.095
0.156
0.360
0.2865
0.2887
Level 4
BFGS; Grid: 50×50; ΔPVI=0.0025
0.122
0.093
0.092
0.144
0.385
0.2953
0.2957
Number of simulations
Computational cost per simulation
Computational cost per level
(d)
Ω=2; r_o=12.5 $/bbl
PVI
0
0.2
0.4
0.6
0.8
Level 1
PSO; Grid: 50×1; ΔPVI=0.02
PVI1 = PVI3; PVI2 = PVI4
0.133
0.143
0.133
0.143
0.347
NPV
0.4555
Level 2
PSO; Grid: 50×1; ΔPVI=0.02
0.104
0.073
0.116
0.225
0.412
0.4555
0.4715
Level 3
BFGS; Grid: 50×1; ΔPVI=0.001
0.102
0.087
0.112
0.218
0.412
0.4666
0.4667
Level 4
BFGS; Grid: 15×15; ΔPVI=0.001
0.137
0.143
0.109
0.178
0.359
0.4472
0.4505
Level 5
BFGS; Grid: 50×50; ΔPVI=0.002
0.109
0.124
0.130
0.160
0.401
0.4569
0.4590
Number of simulations
Computational cost per simulation
Computational cost per level