9-1-2023

Production Allocation Under Uncertainties

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PRODUCTION ALLOCATION UNDER UNCERTAINTIES

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Abstract

- In developing oil and gas projects, constraints limit the production potential of the field's hydrocarbons. They include lack of adequate surface facilities, low oil prices, and contractual restrictions.
- This study investigated Guide rate and Priority allocation options available in Eclipse software for conventional wells.
- It was found that Guide rate option generally exhibited better performance than the Priority option with oil production initiated from low producer wells

Introduction

- Field constraints like facilities, contractual agreements, and oil prices restrict its total production rate. Allocation of each well's production rate is a challenge (Guyaguler & Byer, 2007).
- McCracken & Chorneyko (2006) proposed allocation using downhole pressure to determine each layer's flow rate. In Asadollahi et al. (2012), guide rate approach was used to determine each completion's monthly production rate.
- This study focuses on Guide rate and Priority approaches to propose guidelines.

Methodology

- Guide rate- continuous flow control method

$$GRp = \frac{(POTp)^{A}}{B+C(R1)^{D}}$$

GRp-guide rate, POTp-wells potential flow rate
R1-phase potential ratio , A, B, C,D-coefficients

(Asadollahi et al. ,2012))

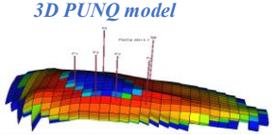
- Priority- ON/OFF control method

$$\text{Priority} = \frac{A+BQo+CQw+DQg}{E+FQo+GQw+HQg}$$

Q_o,Q_w,Q_g-wells potential oil, water, gas rate while
A,B,C,D,E,F,G,H - coefficients (Schlumberger, 2014)

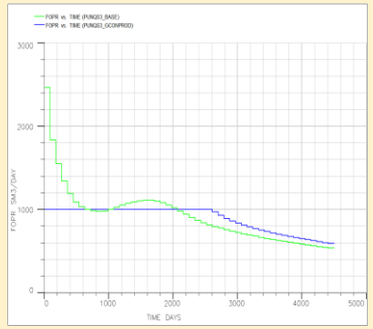
- PUNQ-S3 Model (4 producer wells)

Figure 1
3D PUNQ model



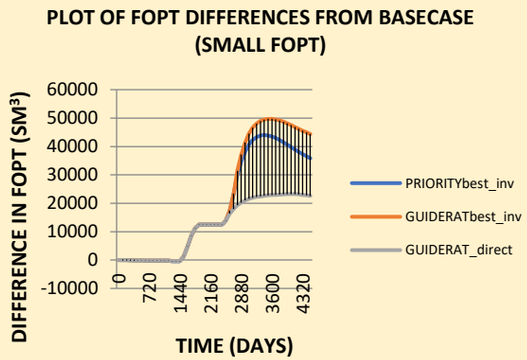
Results and Discussion

Figure 2
Base-case Vs the constrained case



(Tugume, 2014)

Figure 3
Production improvement from base case



(Tugume, 2014)

- **Production constraint** was applied to restrict oil flow rate to maximum of **1000m³/day** (Figure 2) for all the four wells limiting full flow potential. The study was first conducted on **single realization** (constant parameters).

Table 1
Guidelines for Guide rate and priority best cases

	coefficients								FOPT(SM³)
Priority	A	B	C	D	E	F	G	H	
CASE2INV	1.0	0.0	0.0	0.0	5.0	5.0	0.0	0.0	4016267
Guide rate									
CASE_8	-0.8	0.0	1.0	0.3	0.0	0.0			4024796
Improvement for guide-rate CASE_8 with respect to priority CASE2INV									8529

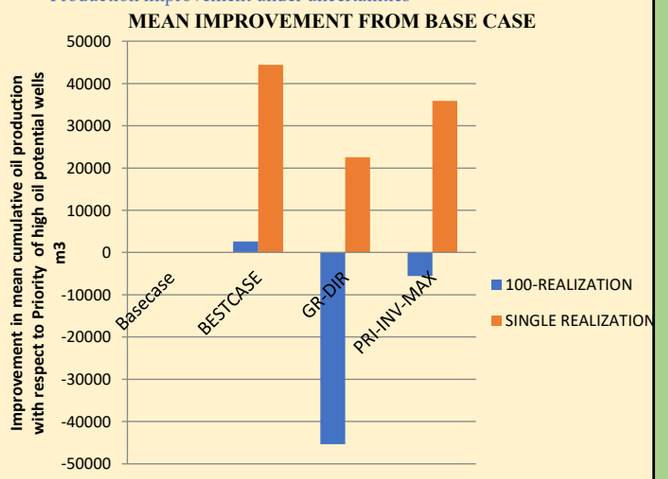
Table 2
Performance of guidelines under uncertainties

	Priority (Qo)	Guiderate(1/Qo)	Guiderate (Qo)	Priority (1/Qo)
Single realization	3,980,382	4,024,796	4,002,942	4,016,267
100 Realization	3,309,880	3,312,520	3,264,538	3,304,328

(Tugume, 2014)

- Under the **Guide rate** option, high field oil production total (FOPT) was realized by **initiating production** from wells with **low potential** (varying parameter A) in addition to **slightly** penalizing wells with much water.
- The **Priority** option which is **ON/OFF** was studied by varying coefficients to determine the highest FOPT. High oil production was obtained when priority was given to wells with **low oil potential**. This was so because high producer wells also produce a lot of water and penalizing them means limiting their flow.
- The best guidelines for both options are presented in Table 1 above. When these two best cases were compared, Guide rate best case had about 5,500 m^3 more of oil produced than the rest (Figure 3).
- When these cases were subjected to varying reservoir conditions (i.e 100 realizations), there was a significant improvement by the previously considered worst case performing better than the Priority best case.
- This effect is attributed to variations in porosity and permeability.
- Overall, the Guide rate best case on average remained consistent by performing better than the rest (Table 2 and Figure 4)

Figure 4
Production improvement under uncertainties



(Tugume, 2014)

Conclusion & Recommendation

- Guide rate guidelines developed are consistent with reservoir uncertainties.
- Initiating flow from wells with low oil production potential and penalizing wells that produce water, yields high oil.
- More study should be conducted with liquid rate and gas to test the consistence of Guide rate option.

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References