Optimization of gas injection allocation to increase oil production using Gbest-guided artificial bee colony algorithm

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Abstract. Oil comes from fossils thousands of years ago and it is natural resource that can't be renewed. If it used continuously, the oil supplies will eventually run out. One way to optimize an oil production is by using gas lift. When the supply of the gas injection is limited, the total available gas should optimally distributed among the oil wells of the field such that the total production of oil is maximized. In this paper, Gbest-guided artificial bee colony (GABC) will became the optimization techniques while Least square is used to make the mathematical model from the correlation between gas injection and oil production. Contribution of this research is to find the fittest mathematical model and implement GABC to find the maximum value of mathematical model. The selected model is 10^{th} order polynomial with R-square value of 1 and Sum of squares error (SSE) is 34.091. GABC will optimize the model and it will be compared to another optimization method such as Artificial bee colony (ABC). The results are GABC is better than ABC for each case with 4812.877 barrel oil per day (Bopd), 5107.873 Bopd, and 5142.156 Bopd respectively, while the best C values in GABC is 2.

1. Introduction

Oil is a natural resource that can not be renewed and it can help human to do their work. With the increasing population on earth, the need for oil for daily needs is also increasing. If it used continuously, oil supplies will decrease and eventually run out. This is what causes researchers to always look for new ways to increase oil production, and one of them known as gas lift.

Gas lift is a method for lifting the oil by injecting gas into the well, which will cause the oil to rise to the surface so more oil production can be obtained [1]. It's not always the more injected gas will produce more oil. The characteristics of each well differ from one another despite being in the same field [2]. Each well has their own optimum point, where the injected gas will produce more oil than the other points. The comparison curve between gas injection and oil production is called Gas Lift Performance Curve (GLPC) [3].

This paper will discuss about how to optimize oil production using Least square to find mathematical model on GLPC in each well and Gbest-guided artificial bee colony (GABC) to optimize it. The purpose of this research is to maximize oil production and minimize the gas injection. The dataset comes from previous research and synthetic data [4]. The rest of this paper are literature review (section 2), proposed method (section 3), result and analysis (section 4).