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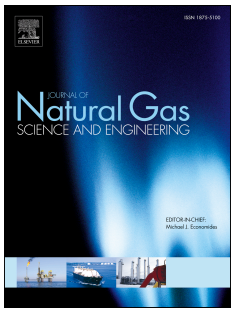

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Meysam Naderi, Ehsan Khamehchi

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Application of DOE and metaheuristic bat algorithm for well placement and individual well controls optimization

Meysam Naderi[a], Ehsan Khamehchi[a, *]

[a]Faculty of Petroleum Engineering, Amirkabir University of Technology (Tehran Polytechnic), Hafez Avenue, Tehran, Iran

Highlights

- ✓ DOE, RSM and BA optimizer are used for performance prediction of WDGR.
- ✓ Significant interactions that affect the production optimization can only be identified by use of DOE strategy.
- ✓ Uniform design successfully applied in determination of optimum number of wells.
- ✓ Reducing gas production rate increases the ultimate RF and consequently UNPV.
- ✓ Considering economical constrains and time value of money, it is favorable to produce with high rates over short time scales.
- ✓ Reducing THP always maximizes ultimate RF and consequently UNPV regardless of reservoir properties, and increasing THP only minimizes W_p.

Abstract

The design of an optimal gas field development and production management is a complicating task because of influencing various factors on decision-making process. Typical factors include number and type of wells, well locations, and production constraints, economic factors of capital expenditure, operating costs, gas sale price, and different engineering and geological parameters. The situation is further complicated due to uncertainty associated with the nonlinear problem of field development optimization.

In this study, first, design of experiment (DOE) techniques including uniform design (UD) and Box-Behnken design (BBD) are used for performance prediction of water drive gas reservoirs. Next, a new metaheuristic bat inspired algorithm (BA) will be applied in optimization process of objective function. Undiscounted net present value (UNPV) is used as an objective function for the determination of optimal number of wells (N), individual well locations (I and J), production rate (Q_g), perforation thickness (H_p) and the limit of tubing head pressure (THP) for different average reservoir permeability (K_G) and permeability anisotropy (K_v/K_h). In this regard, part of gas

* Corresponding author. Tel.: 98 21 6454 5154
E-mail addresses: khamehchi@aut.ac.ir