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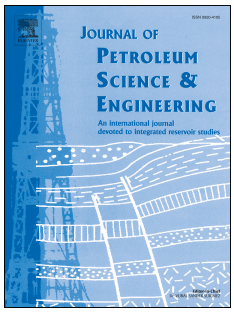

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Hyungjun Yang, Junyi Kim, Jonggeun Choe

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Field development optimization in mature oil reservoirs using a hybrid algorithm

Hyungjun Yang[a], **Junyi Kim**[a], and **Jonggeun Choe**[a,*]

[a]Department of Energy Systems Engineering, Seoul National University, Seoul, 08826, South Korea

[*]Tel: +82-2-880-8081, Fax: +82-2-871-8938, E-mail Address: johnchoe@snu.ac.kr

Abstract

Many optimization schemes have been proposed to simultaneously optimize various variables such as well locations, well operation schedules, well types, and the number of wells. However, most of these approaches often focused on fixed well type without considering conversion of existing wells.

This paper proposes a new optimization for mature oil field development. Since converting from producers to injectors is a common practice in mature oil field, we have to optimize simultaneously type conversion schedules of all existing producers and infill wells as well as the number of infill wells, their locations, and operation schedules. We propose a new hybrid algorithm, which combines differential evolution (DE) algorithm and mesh adaptive direct search algorithm (MADS) to solve our optimization task.

By considering well type conversion, it will increase the complexity of searching space but provide more realistic and optimal development plan. We demonstrate it in 2D synthetic and 3D PUNQ-S3 reservoirs for optimal field development. The proposed optimization considering well type conversion provides higher net present value than the fixed well type optimization in the both cases. The hybrid algorithm also shows better search performances than DE and MADS algorithms. Thus, we conclude that consideration of well conversion schedules is necessary for economical field development scenarios in mature oil fields.

Keywords: field development optimization, well type conversion schedule, mature oil reservoir, differential evolution (DE), mesh adaptive direct search (MADS), hybrid algorithm.

* Corresponding author: J. Choe(e-mail: johnchoe@snu.ac.kr)