World Academy of Science, Engineering and Technology
International Journal of Chemical and Materials Engineering
Vol:11, No:08, 2017

A First Step towards Automatic Evolutionary for Gas Lifts Allocation Optimization

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Abstract : Oil production by means of gas lift is a standard technique in oil production industry. To optimize the total amount of oil production in terms of the amount of gas injected is a key question in this domain. Different methods have been tested to propose a general methodology. Many of them apply well-known numerical methods. Some of them have taken into account the power of evolutionary approaches. Our goal is to provide the experts of the domain with a powerful automatic searching engine into which they can introduce their knowledge in a format close to the one used in their domain, and get solutions comprehensible in the same terms, as well. These proposals introduced in the genetic engine the most expressive formal models to represent the solutions to the problem. These algorithms have proven to be as effective as other genetic systems but more flexible and comfortable for the researcher although they usually require huge search spaces to justify their use due to the computational resources involved in the formal models. The first step to evaluate the viability of applying our approaches to this realm is to fully understand the domain and to select an instance of the problem (gas lift optimization) in which applying genetic approaches could seem promising. After analyzing the state of the art of this topic, we have decided to choose a previous work from the literature that faces the problem by means of numerical methods. This contribution includes details enough to be reproduced and complete data to be carefully analyzed. We have designed a classical, simple genetic algorithm just to try to get the same results and to understand the problem in depth. We could easily incorporate the well mathematical model, and the well data used by the authors and easily translate their mathematical model, to be numerically optimized, into a proper fitness function. We have analyzed the 100 curves they use in their experiment, similar results were observed, in addition, our system has automatically inferred an optimum total amount of injected gas for the field compatible with the addition of the optimum gas injected in each well by them. We have identified several constraints that could be interesting to incorporate to the optimization process but that could be difficult to numerically express. It could be interesting to automatically propose other mathematical models to fit both, individual well curves and also the behaviour of the complete field. All these facts and conclusions justify continuing exploring the viability of applying the approaches more sophisticated previously proposed by our research group.

Keywords : evolutionary automatic programming, gas lift, genetic algorithms, oil production
Conference Title : ICOGPE 2017 : International Conference on Oil, Gas and Petrochemical Engineering
Conference Location : Lisbon, Portugal
Conference Dates : August 17-18, 2017