## Abstract

The optimization of water alternating gas injection (WAG) process is a complex problem, which requires a significant number of numerical simulations that are time-consuming. Therefore, developing a fast and accurate replacing method becomes a necessity. Proxy models that are light mathematical models have a high ability to identify very complex and non-straightforward problems such as the answers of numerical simulators in brief deadlines. Different static proxy models have been used to date, where a predefined model is employed to approximate the outputs of numerical simulators such as field oil production total (FOPT) or net present value, at a given time and not as functions of time. This study demonstrates the application of time-dependent multi Artificial Neural Networks as a dynamic proxy to the optimization of a WAG process in a synthetic field. Latin hypercube design is used to select the database employed in the training phase. By coupling the established proxy with genetic algorithm (GA) and ant colony optimization (ACO), the optimum WAG parameters, namely gas and water injection rates, gas and water injection half-cycle, WAG ratio and slug size, which maximize FOPT subject to some time-depending constraints, are investigated. The problem is formulated as a nonlinear optimization problem with bound and nonlinear constraints. The results show that the established proxy is found to be robust and an efficient alternative for mimicking the numerical simulator performances in the optimization of the WAG. Both GA and ACO are strongly shown to be highly effective in the combinatorial optimization of the WAG process.