SPE 79701 Integrated Optimization for Rate Allocation in Reservoir Simulation

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Reservoir simulators are used to predict future field production but to remain realistic, operating rules and procedures to manage wells and surface facilities are required. To this end, Sequential Quadratic Programming (SQP) was used to set well rates in the facility network of the reservoir simulator. The objective for the majority of models is to maximise the production while observing the pressure constraints, flowrates and stream compositions.

When running models, objectives such as: contract specified production rates, multiple constraints, gas delivery pressure, water handling restrictions, flaring limitations and optimal flowstream compositions need to be achieved. This means that for a reservoir model to be realistic; the user defined and physically defined constraints applied to networks, platforms, pipes and individual wells must be accounted for. Satisfying all of these operating constraints simultaneously can be very time consuming as well as difficult to implement.

Non-linear SQP methods have been implemented in the full field reservoir simulator developed by Exxonmobil. This simulator allows compositional as well as black oil systems to be run. With the use of these tools, Optimized Rate Allocation (ORA) can be utilised to optimally determine well rate settings so that the network objectives and constraints can be simultaneously satisfied. This paper discusses how the method was formulated and the individual well rates were set. How infeasible problems are dealt with is also discussed as combinations of constraints and system requirements can compete rather complement each other.

SUMMARY:

By simply specifying production targets and operating constraints, ORA can be used to quickly set up and run reservoir simulations. Modelers may specify actions to be taken when constraints become active or violated. ORA can also be used in conjunction with custom well management algorithms. Various allocation strategies can then be easily used to gain insight into the controlling factors of the model.