

Coupling between a reservoir and a surface facilities network

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Problem background

The production of oil and gas from a reservoir is aided by the use of simulation models. For instance, once wells have been drilled and production has started, reservoir simulators are used to predict the oil and gas flow out of the reservoir for the coming years. Oil and gas flowing out of a reservoir enter a production network of pipelines, compressors, pumps and other equipment which brings the gas and oil to their right destinations. This network flow is modelled in network simulators. In reality the reservoir and the network form one flow system, and for certain studies it is desirable to simulate the reservoir and network also as one system. If a reservoir simulator and a network simulator are available already, it is required that they be coupled together. The coupling method, however, determines how then the system as a whole will behave. Therefore the coupling method is required to lead to a stable and efficient simulation model of the combined system. The question then is how to achieve this.

Assignment

Here a reservoir takes the form of a collection of very simple tanks, each one having one well. One tank with well is modelled using an ordinary differential equation with a source term representing the well. We take one or more of these as reservoir simulator. For the network we take a simple algebraic system of equations representing flow from the wells into one outlet. This is the network simulator. For the coupling we consider explicit coupling. The question is: under what conditions can it give a stable and efficient method for the combined simulation. The assignment consists of the following parts:

1. Literature study.
2. Analysis of the coupling method.
3. Testing the methods using simple reservoir and network models.
4. Writing the thesis.