Supplementary file

Simulation and optimization of a coupled reservoir and multi-phase flow network model

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Repository overview

The source code for the software is contained in the group `DigiWell` on SINTEF's GitLab server. Fig. S1 shows how the code is organized into four repositories:

1. `DataScenarios.jl` contains data files and Julia source code for modelling costs and prices in economic scenarios (cf. Section 3.3).
2. `df-tr-linearly-constrained` contains the derivative-free trust region algorithm from Section 3.2, implemented in MATLAB code.
3. `DigiWellFlowModel` contains the C++ network model from Section 2.1.
4. `Reservoir Network Coupling` contains MATLAB code for the coupled simulator itself, example cases, optimization calculations, and some tools. Fig. S1 shows the main folders in this repository.

The main features in each repository except `DigiWellFlowModel` are documented in local `README` files, and the various pieces of documentation are collected in the `documentation` folder in `Reservoir Network Coupling`.

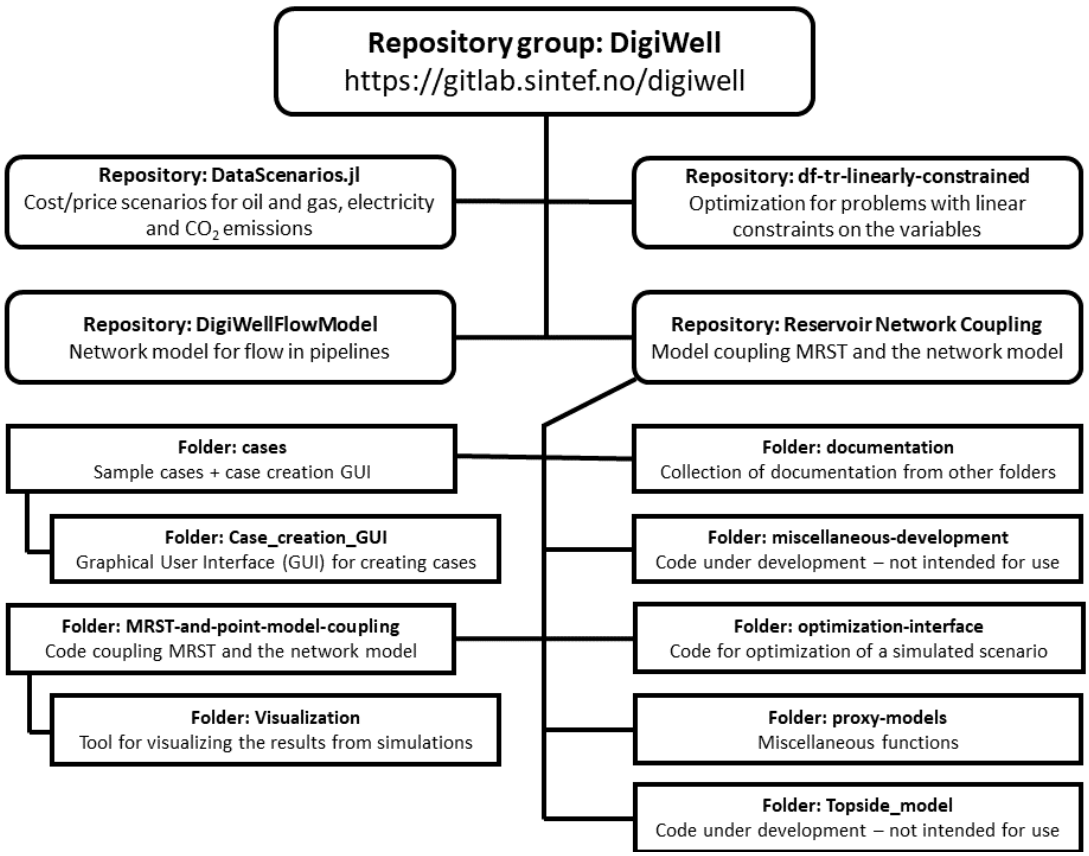

Fig. S1. Overall Git repository structure for the simulation and optimization software. Only the most important folders and subfolders are shown.

Tools

The source code includes two tools that aid the user in using the software. One aids in setting up a simulation case, and the other aids in visualizing some of the results of a simulation. These tools make it significantly easier to use the software.

Graphical user interface

The Graphical User Interface (GUI) aids the user in specifying simulation parameters and setting up the pipelines and their connections and boundary conditions. These are stored as text files which can also be manually edited later by experienced users. Fig. \ref{fig:GUI} shows the most important windows in the GUI.

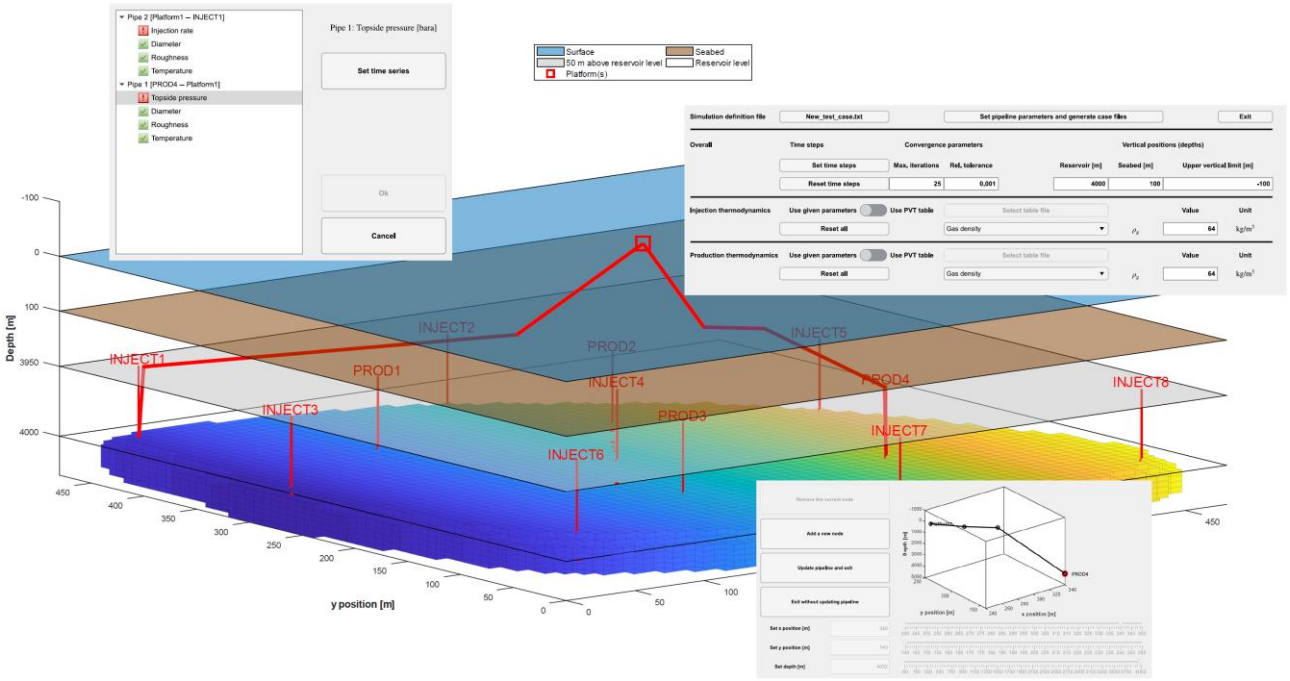

Fig. S2. The GUI for creating simulation cases.

Visualization tool

The visualization tool displays and saves plots and animations of some of the main quantities in a simulation case. Fig. S3 shows an example of such a visualization.

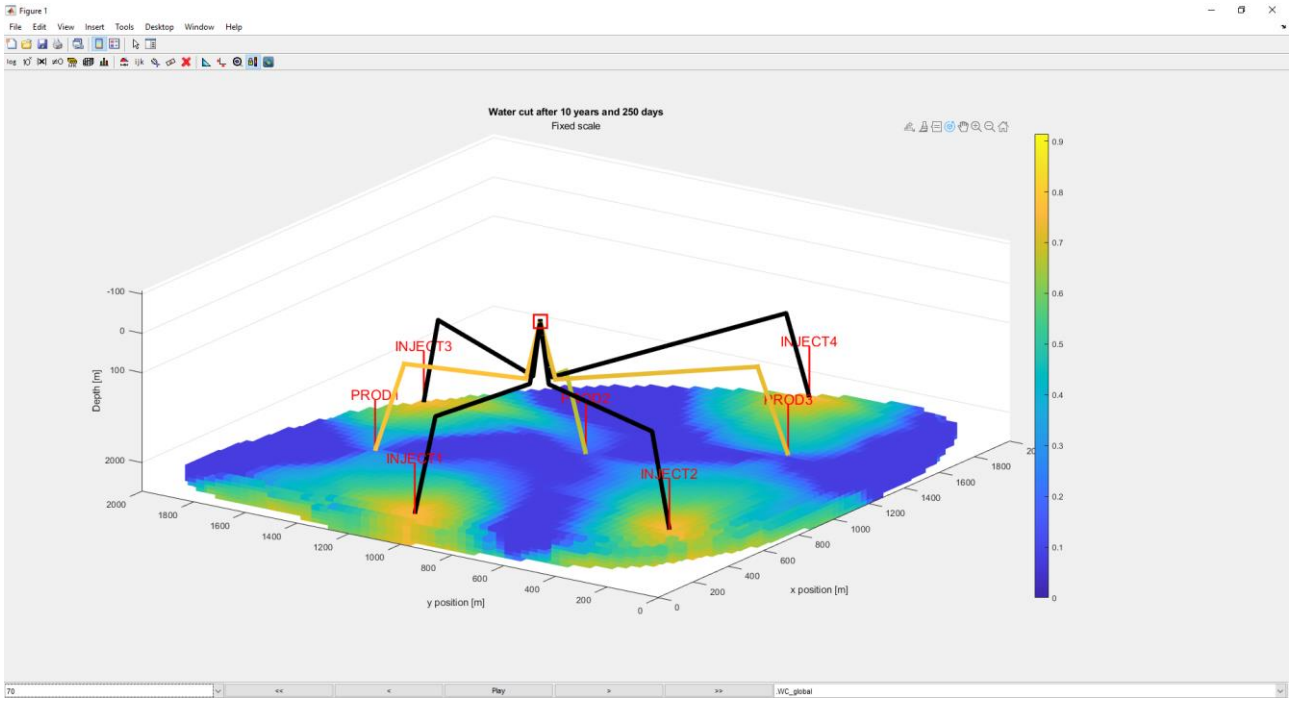

Fig. S3. Visualization of the water cut in a simulated case, with water injection and fixed colour scale. The injection pipelines are black, since injected fluids don't contain oil, making the water cut an irrelevant quantity for these pipelines.