Comparison of Different Concepts for Modeling Two-phase Flow with Disappearing Gas Phase

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Carbon Capture and Storage (CCS) is a recently discussed new technology, aimed at allowing an ongoing use of fossil fuels while preventing the produced CO2 to be released to the atmosphere. CSS involves two components (water and CO2) in two phases (liquid and gas). To model the process, a multiphase flow equation is used. One of the big problems arising in two-phase flow simulations is the disappearance of the gas phase, which leads to a degeneration of the equations satisfied by the saturation. A standard choice of primary variables, which is the pressure of one phase and the saturation of the other phase, cannot be applied here.

There are several possibilities to overcome this problem. A comparison between these methods, to find out about the advantages and disadvantages, has not been conducted yet.

We implement different possibilities of primary variables in the DUNE simulation framework and compare the results of the numerical simulations for some test cases. Using the same discretization method in the identical simulation framework allows an unbiased comparison between the different concepts and their numerical properties.