Characterization and lumping are always performed when dealing with reservoir fluids. The number of pseudocomponents in a compositional reservoir simulation is normally between three and eight. In order to optimize the reservoir performance, it is necessary to know a detailed composition of the product stream from the reservoir. This paper deals with the problems of how to come from the lumped system (for which the reservoir simulation was performed) to a description of the full system (which is important in order to optimize the down-stream facilities). The equations of the delumping procedure are shown and the application of the method is illustrated through examples, including a constant volume depletion experiment and the fifth SPE Comparative example with a fluid description from a North Sea reservoir (with the calculated composition after a lumping, an experiment and a delumping).

Introduction

The use of reservoir simulators play an important role when planning, developing and producing almost every oil and gas field. It is accepted that the compositional simulation is a necessary tool when complicated fluid behaviour needs to be investigated accurately e.g. near critical fluids, gas condensates or gas injection processes.

A common calculation procedure is to divide the reservoir into a number of gridblocks. For each gridblock a mass balance is applied together with the iso-fugacity criteria for the phases present (oil, gas or water). The number of blocks used in full field models can be in the range from very few (20-50) up to several thousand blocks. However, due to the large amount of calculations required and the problems related with obtaining an accurate fluid description especially for the heaviest oil fraction, it is normal to simplify the fluid description by the use of pseudo-components (average components or components from characterization of the heavy oil fraction). The number of pseudo-components by most authors recommended to not less than six. In practice a number from three to eight is used.

Where a minimum of six pseudocomponents are considered reasonable for the up-stream calculations it is a far too low number for the down-stream calculations e.g. a distillation calculation will normally require detailed knowledge of 50-100 components for sufficient accuracy - particular in situations where different oils are mixed. Thus it is important to calculate detailed component information from the output of the compositional reservoir simulation. This calculation is here referred to as delumping.

One of the first delumping method proposed by Drohm et al. is based on a Gibbs energy minimization using correlation's from a previous suggested lumping procedure. Danesh et al. published a K-factor method using the acentric factor and the reduced temperature. This paper will mainly use the method suggested by Leibovici et al., which is based on the simplified flash of Michelsen.

Calculations are made to show how the delumping can be used to generate a full component description from a lumped system. Especially the aspect of using the output from a compositional reservoir simulator in a process simulator is an important application for the delumping procedure. An example of a calculation from a constant volume depletion (CVD) experiment and a reservoir simulation with the calculated composition after a lumping, an experiment and a delumping are also given.

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