# STARS – Advanced Process and Thermal Reservoir Simulator

## Preface

Simulador de processos avançados (advanced process) que inclui as seguintes opções:

* **Chemical/polymer flooding**. From OilGlossary: A general term for injection processes that use chemical solutions. Substances are used to reduce surface tension between oil and water in the reservoir, whereas polymers are employed to improve sweep efficiency.
* **Thermal recovery applications**. From OilGlossary: A general term for injection process that introduce heat into a reservoir. It’s used to produce viscous and heavy oil. During the process, crude oil undergoes physical and chemical changes because of the heat supplied. Physical properties such as viscosity, specific gravity and interfacial tension are altered. The chemical changes involve different reactions such as cracking (destruction of carbon-carbon bonds to generate lower molecular weight compounds) and dehydrogenation, which is the rupture of carbon-hydrogen bonds.
* **Steam injection**. From OilGlossary: A method in which a well is injected with steam and then subsequently put back on production. The method consists into three steps. First, a slug of steam is introduced into the reservoir. The second stage, or soak phase, requires that the well be shut in for several days to allow uniform heat distribution to thin the oil. Finally, in the third stage, the thin oil is produced through the same well. This cycle is repeated as long as oil production is profitable. This method is used extensively in heavy-oil reservoirs, tar sands, and in some cases improve injectivity prior to steamflood or in situ combustion.
* **Dual porosity/permeability**
* **Horizontal wells**
* **Directional permeabilities**
* **Flexible grids**
* **Fireflood.** From OilGlossary: Thermal recovery process in which a flame front is generated in the reservoir by igniting a fire at the sandface of an injection well. As the fire burns, it moves through the reservoir toward production wells, heat from the fires reduces oil viscosity and helps vaporize reservoir water to steam.

## Introduction to STARS

STARS is a three-phase multi-component thermal and steam additive simulator. It supports Corner-Point grids. Some of its features are:

* Dispersed component including Foam
* Naturally fractured reservoirs: Dual Porosity model, dual permeability model, multiple interacting continua model (MINC) or vertical refinement (VR). The basic approach consists of two parts: fracture and matrix. The fractures have small storativities and are the primary conduits of fluid flow, whereas the rock matrices have low fluid conductivities but larger storativities.
* AIM – Adaptative Implicit Method. In many cases, only a small number of blocks need to be solved by the implicit method, most of the can be solved by the explicit method. AIM option accomplishes this.
* Discretized Wellbore model. It discretizes wellbore flow and solves the resulting coupled wellbore/reservoir flow problem simultaneously

É necessário que um poço mude de configuração (injetor/produtor) para que o processo de injeção de vapor seja simulado.

Esquemas de passo de tempo adptativo conferem um fator de aumento máximo de 2.3 para o passo de tempo. Ver palavra-chave NORM

Estudar a possibilidade de implementar cálculos de balanço material (material balance) a fim de que seja possível o usuário do software controlar a precisão da simulação.

## Reservoir description

* O STARS trabalha com esquema de discretização de nove pontos, as transmissibilidades para esse caso são calculadas conforme descrito em SPE 16975

## Component Properties

* **MODEL:** Especifica a quantidade de componentes que serão simulados e indica também o tipo dos componentes dividindo-os entre as possíveis fases (sólida, water-like, oil-like, gases não-condensáveis). Os gases não-condensáveis são tão voláteis que sua solubilidade em líquidos e sua condensação podem ser desprezadas, exemplos são os gases oxigênio e nitrogênio utilizados na modelagem do ar. Os componentes sólidos requerem somente os dados quanto a capacidade térmica e densidade. Oil-like componentes são encontrados somente na fase óleo no particionamento padrão dos componentes.
* **KV1, KV2, KV3, KV4, KV5** (K Value correlations): Especifica os coeficientes da correlação utilizada no cálculo dos K-value gás-líquido.
  + Os K-values podem ser computados a partir dessa correlação ou através do uso de valores tabelados.
  + Os K-values para componentes do tipo water-like são calculados internamente pelo simulador. (De que maneira?).
  + K-values líquido-líquido são especificados através de tabelas. Os K-values são números não-negativos.
  + KEYCOMP pode ser utilizado para informar a dependência dos K-values com algum componente, informar o nome dele