

Title: CAPE-OPEN Physical Property Package based on Black-Oil correlations for upstream applications

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Summary:

In flow modeling of hydrocarbon reservoirs and production systems, Black-Oil correlations are usually used for computing thermodynamic states and fluid properties. Several correlations are available in the literature and provide more or less accurate predictions for oil, volatile oil and gas condensate. These models are especially used when detailed fluid analyses are not available or preliminary work is being performed. Black-oil correlations are usually tuned on specific fluid databases.

Main input data of Black-Oil correlations are densities for gas and liquid at standard conditions (or storage conditions) and the Gas/Oil ratio (GOR). For creating a Physical Property Package based on Black-Oil correlations, "light" and "heavy" components have been defined on the basis of vapor and liquid densities obtained at storage conditions. In the Black-Oil model defined for the purpose, it is assumed that the gas phase contains only the light component, while the liquid phase can contain different proportions of both the light and the heavy components depending on pressure and temperature. The amount of dissolved gas (R_s) is calculated using the Black-Oil correlations. The model considers changes of composition, i.e, changes of overall light and heavy component fractions. Then, enthalpy is calculated using specific heat capacities of phase and some physical relations have been implemented for calculating other properties (viscosity, density, ...).

Under these considerations, it has been possible to implement a Physical Property Package based on Black-Oil correlations and the module has been used with success into COFE together with third party unit operations to model simple upstream production system.