In the Name of GOD

Introduction to CMG

(S.M.R. Pishvaie, Spring 1388)

BASIC DEFINITIONS/CONCEPTS

History: Established in 1977, Canadian corporation

Principal activities: Reservoir simulation programs for the petroleum industry, Technology transfer, training courses and advisory services, specialized software for oil and gas, and environmental applications.

Numerical simulator: A collection of coupled mathematical models, in the form of either equations or computer code, from which conclusions can be drawn from a set of assumptions.

Reservoir simulator: A numerical simulator whose mathematical models correspond to the physical phenomena and processes involved in extracting hydrocarbons from the earth. The assumptions are the fluid and rock data, process parameters, initial and operating strategies, in the form of a data set. The conclusions are fluid productions along with conditions in the reservoir, at various times.

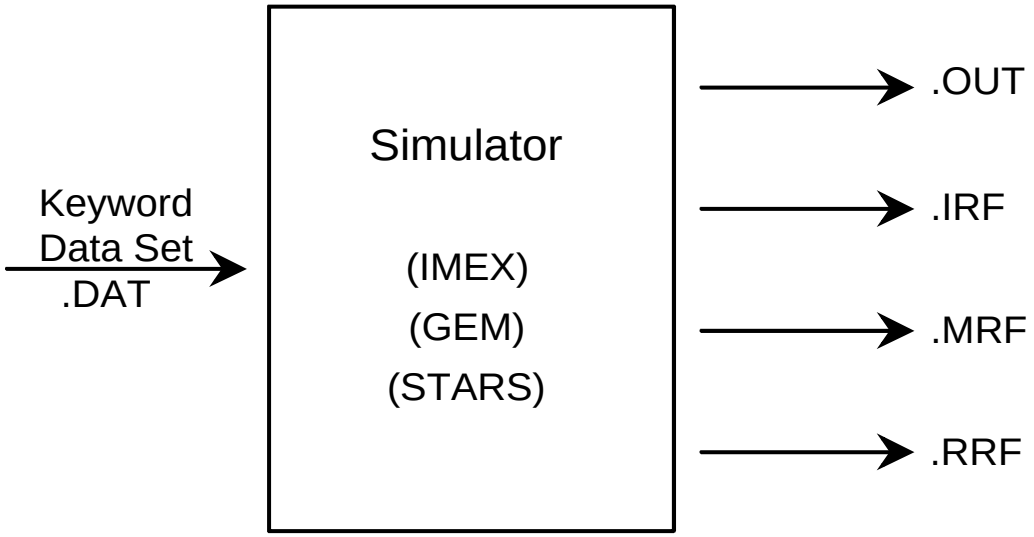
Specifications: CMG is a multi-modular program; each module is suitable for a specific simulation problem/task. The simulator modules include; IMEX, STARS, GEM. There are also more additional supporting modules such as utility programs; WinPROP (for phase behavior and fluid properties prediction/calculation), RESULTS (for visualization and animation of simulation results), BUILDER (for easily inputting data in a GUI manner), LAUNCHER (for centralization of simulation tasks such as project definition) and REPORT.

Simulator Module IMEX: suitable for conventional oil recovery processes such as primary recovery, water flooding, gas flooding, pseudo-miscible and polymer flooding. IMEX does not consider energy balance; hence isothermal operations can be simulated.

Simulator Module STARS: specially designed for simulating conventional chemical processes, such as caustic, polymer, foam and gel processing. STARS considers energy balance, hence the strongest module in numerical manipulations amongst the other modules. This characteristic enables and empowers the STARS to handle the heavy oil recovery processes such as in-situ combustion and steam flooding.

Simulator Module GEM: This simulator is much powerful in thermodynamics issues. Therefore, it can be used in compositional oil recovery processes, such as miscible, CO_2, vaporizing and condensing systems.

Work flow: The overall process to run a successful simulation is; 1) inputting data, 2) running one out of three simulators, 3) obtaining results (output) to manipulate, visualize and post-processing.



1) Inputting: All the data required for running the simulation will be embedded in a dataset file called "Keyword Data set". This (ASCII/Text) file can be prepared or edited by either a text processor such as Notepad, or by the GUI utility program (Model) BUILDER. It is recommended for the first-users to try with text-editors rather than BUILDER. The constructed input data consist of a main file with the extension .dat like 'Jurassic.dat' and includes files with the extension .inc as in 'grid.inc'.
2) Running: after preparing and validating the data set of project, we can feed it to one of appropriate simulator modules, i.e.; IMEX, GEM or STARS.
3) Outputs: The output from IMEX consists of three files with extensions - .out, .irf and .mrf and the same name as the .dat input file (i.e. Jurassic.*). The .out and .irf extensions are ASCII files and can be opened with an (text/ASCII) Editor. The .mrf extension is a binary file and should not be opened with an Editor. Interpretation of simulation results is done using three CMG programs; Results Graph, Results 3D and Results Report.

The whole process of constructing input data, running a simulator and interpreting simulation results is done from one utility program - LAUNCHER