In the Name of GOD

Introduction to CMG

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

Keyword system (Data set preparation)

In this session we review the keyword system through a typical data set file.

```
**************************************************************
  ** mxspe001.dat:       First SPE Comparative Solution Model          **
**************************************************************
**************************************************************
  ** FILE:   MXSPE001.DAT                                      **
  ** MODEL:  3x3x3                SPE 1              GAS INJECTION **
* **************************************************************
  ** This is a 10x10x3 cartesian grid gas injection problem (SPE 1). The gas injector **
  ** is located in block (1,1,3), and the producer in block (10,10,1). There is a **
  ** large permeability contrast in the vertical direction.                **
  **************************************************************
  ** CONTACT:    CMG,   (403)531-1300;   282-6495 (fax);support@cmgl.ca    (Internet) **
  **************************************************************
```

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**************************************************************
** I/O Control Section                                      **
**************************************************************
*FILENAME    *OUTPUT   'xmp02.out'
             *INDEX-OUT  ' xmp02.irf'
              *MAIN-RESULTS-OUT   ' xmp02.mrf'
              *INDEX-IN           ' xmp01.irf'
              *MAIN-RESULTS-IN            ' xmp01.mrf'
*TITLE1
'First SPE Comparative Solution Project'
*TITLE3
'(See Odeh, A.S., J.P.T., 33, pp.13-25, 1981.)'
*INUNIT *FIELD
*WPRN   *WELL   10
 *WPRN   *GRID   *TIME
 *WPRN   *ITER   *BRIEF
*OUTPRN *WELL   *BRIEF
 *OUTPRN *RES    *NONE
 *OUTPRN *TABLES *NONE
 *OUTPRN *GRID   *SO *SG *PRES *BPP *IMEXMAP
 *WSRF   *GRID   *TIME
 *WSRF   *WELL   1
 *OUTSRF *GRID   *SO *SG *PRES *BPP
```

Comment [M1]: I/O CONTROL DATA GROUP includes the following options:
1-FILE NAMES,
2-DATA SET TITLE (*TITLE1, *TITLE2, *TITLE3, *CASEID),
3-FREQUENCY OF WRITING TO THE OUTPUT FILES (*WPRN, *WSRF),
4-CONTENTS OF THE OUTPUT FILES (*OUTPRN, *OUTSRF),
5-RESTART (*RESTART, *WRST, *REWIND),
6-UNITS (*INUNIT, *OUTUNIT) and
7- OTHERS (*CHECKONLY, *OUTDIARY, *RANGECHECK, *DEBUG, *MAX ERROR)

Comment [M2]: Syntax:
* FILENAME file-types name-options
In which file-types may be selected from the list below:
*OUTPUT
*INDEX-OUT
*MAIN-RESULTS-OUT
*REWIND-OUT
*INDEX-IN
*MAIN-RESULTS-IN
*REWIND-IN
And name-options being selected as:
"
'filename'
*PROMPT
*SCREEN

Comment [M3]: 1st SPE match.

Comment [M4]: When to print?

Comment [M5]: What to print?

```
**********************************************************************************
** Reservoir Description Section                                  **
**********************************************************************************

*GRID *CART 10   10    3    ** 10 blocks in each the I (x) and J (y) directions.
                            ** 3 layers in the K (z) direction.
*DI *CON 1000.0             ** I direction block dimensions constant at 1000 ft.
*DJ *CON 1000.0             ** J direction block dimensions constant at 1000 ft.
*DK *KVAR                   ** K direction block dimensions (layer thicknesses)
 50.0 30.0 20.0             ** are 50 ft., 30 ft. and 20 ft. for the bottommost
                            ** middle and uppermost layers, respectively.
*DEPTH 1 1 1 8400.0         ** Depth to center of first block, in bottom layer.
*POR *CON 0.3               ** Porosity is constant throughout the reservoir.
*CPOR   3.0E-6              ** Rock compressibility and
*PRPOR 14.7                 ** reference pressure.
*PERMI *KVAR                ** Each of the I, J, and K permeabilities are
  200.0   50.0  500.0       ** constant within each layer of the reservoir,
*PERMJ *KVAR                ** but vary from layer to layer. Hense the use
  200.0   50.0  500.0       ** of *KVAR to input them layer by layer. Note
*PERMK *KVAR                ** that the first K layer is at bottom of the
   20.0   40.0   60.0       ** reservoir.

*MODEL *BLACKOIL            ** Solve three equations.
```

```
**********************************************************************************
** Component Property Section                                    **
**********************************************************************************
*PVT
** p            rs          bo          eg          viso       visg
  14.70000   1.00000   1.06200   6.00000   1.04000 0.0080000
   264.700  90.50000   1.15000  82.70000 0.9750000 0.0096000
   514.700   180.000   1.20700   159.000 0.9100000 0.0112000
  1014.700   371.000   1.29500   313.000 0.8300000 0.0140000
  2014.700   636.000   1.43500   620.000 0.6950000 0.0189000
  2514.000   775.000   1.50000   773.000 0.6410000 0.0208000
  3014.700   930.000   1.56500   926.000 0.5940000 0.0228000
  4014.700  1270.000   1.69500  1233.000 0.5100000 0.0268000
  5014.700  1618.000   1.82700  1541.000 0.4490000 0.0309000
  9014.700  2984.000   2.35700  2591.000 0.2030000 0.0470000
** Note : The above PVT data violates the total hydrocarbon compressibility check. To correct,  you could either
**change rs value at p=5014.7 from 1618 to 1600 or to change the last bo entry  from 2.357 to 2.352.  Other
**possibilities could be equally applied. The above corrections  were tested and they have insignificant effects.
  *DENSITY *OIL    46.244
  *DENSITY *GAS     0.0647
  *DENSITY *WATER  62.238
  *CO    1.3687E-5
  *CVO   4.6000E-5
  *BWI   1.0410
  *CW    2.9886E-6
  *REFPW 14.7
  *VWI   0.31
  *CVW   0.0
```

*ROCKFLUID

****

** **Rock-Fluid Property Section** **

****

*RPT 1

*SWT

** sw krw krow

0.1200000 0.0 1.0

0.8200000 0.0 0.0

*SLT

** sl krg krog

0.12 0.984 0.0

0.15 0.98 0.0

0.30 0.94 0.0

0.40 0.87 1.0000E-4

0.50 0.72 0.001

0.55 0.6 0.01

0.60 0.41 0.021

0.70 0.19 0.09

0.75 0.125 0.2

0.80 0.075 0.35

0.88 0.025 0.7

0.95 0.005 0.98

0.98 0.0 0.997

0.999 0.0 1.0

1.0 0.0 1.0

```
*INITIAL
**********************************************************************************
** Initial Conditions Section                                    **
**********************************************************************************
*VERTICAL *BLOCK_CENTER *WATER_OIL_GAS ** Use vertical equilibrium calculation.
*PB *CON    4014.7          ** buble point pressure
*REFDEPTH   8400.           ** Give a reference depth  and
*REFPRES    4800.           ** associated pressure.
*DWOC       9500.           ** Depth to water-oil contact
*DGOC       7000.           ** Depth to gas-oil conttact


*NUMERICAL
**********************************************************************************
** Numerical Control Section                                    **
**********************************************************************************
*DTMAX       1000.        ** Maximum time step size
*MAXSTEPS    100          ** Maximum number of time steps
*NORM *PRESS  1000.0       ** Normal maximum changes per time step
*NORM *SATUR     0.20
*AIM  *THRESH    0.25 .25   ** Use thresh hold switching criteria


*RUN
**********************************************************************************
** Well and Recurrent Data Section                                    **
**********************************************************************************
*DATE 2009 04 22
*DTWELL 1.0


*WELL 1  'Injector'
```

```
*INJECTOR  *UNWEIGHT  1            ** Define the type of well 1.
*INCOMP    *GAS                    ** Injecting gas.
*OPERATE   *MAX  *STG  1.0E+8      ** Operating on a rate specification.
*OPERATE   *MAX  *BHP  20000.0
*MONITOR   *BACKFLOW   *STOP       ** If backflow occurs, stop the simulation.
*PERF 1
** if     jf     kf     wi
   1      1      3      1.0E+5
*WELL 2  'Producer'
*PRODUCER  2                       ** Define the type of well 2.
*OPERATE *MAX  *STO 20000.0        ** Initially, operate on a rate constraint.
*OPERATE *MIN  *BHP  1000.0        ** If the BHP falls below 1000 psi, switch
                                   ** to a minimum pressure constraint.
*MONITOR *MIN  *STO  1000.0  *STOP  ** When the oil rate falls below 1000 bbl/D
                                   ** stop the simulation.
*MONITOR *BACKFLOW          *STOP  ** Stop if backflow occurs.
*MONITOR *GOR       20000.0  *STOP  ** Stop if the GOR exceeds 20000.
** Well geometry for the producer.
**                        rad    geofac  wfrac   skin
*GEOMETRY *K  0.25    0.34    1.0    0.0
*PERF *GEO 2
** if     jf     kf     ff
   10     10     1      1.0


*TIME 3650.0                       ** Time of next well change.
*STOP                              ** Stop the simulation.
```