

第二十六期：离散井模型-数据文件

在第 24、25 期详细讲解离散井模型的理论以及关键字之后，本期将在具体的数据文件中使用离散化井模型：

*****离散化水平井模型*****

RESULTS SIMULATOR STARS 200900 **模拟器选择 stars V2009

TITLE2 'SOURCE/SINK -2D' **主题 2

*INUNIT *SI **单位制为 SI

** *****

TITLE1 'SAGD - BITUMEN-STEAM-3D-DISCRETIZED' **主题 1

TITLE3 'HEATING AND OPERATES WITH MINIMUM BHP 3235. KPA' **主题 3

**CHECKONLY

INTERRUPT STOP

*****输入输出控制*****

WPRN GRID 0

WPRN SECTOR 0

WSRF WELL 1

WSRF GRID 1

WSRF SECTOR TIME

WPRN ITER 1

OUTPRN WELL LAYPHASE

OUTPRN GRID KRG KRO KRW MASDENG MASDENO MASDENW OBHLOSS PRES SG SO SW

TEMP VISO

**SMALL

OUTPRN RES ALL

OUTPRN ITER BRIEF

OUTSRF GRID PRES SG SO SW TEMP

OUTSRF WELL COMPONENT ALL

OUTSRF WELL LAYER ALL

OUTSRF SPECIAL MASSFRAC 'Injector-L' 'WATER' WATER

MOLEFRAC 'Injector-L' 'WATER' WATER

VOLFRAC 'Injector-L' 'WATER' WATER

MATBAL AQUEOUS 'WATER'

```
STMQUAL 'Injector-L'  
PHWELL 'Injector-L' PRES SURFACE  
AQFRTOT WATER RATE  
OUTSRF SPECIAL WELLENERGY 'Producer-L' RATE  
STMQUAL 'Producer-L'  
PHWELL 'Injector-L' PRES DOWNHOLE  
  
*XDR *ON  
*PRNTORIEN 2 0  
PRINT_REF ON  
*OUTSOLVR *OFF  
*MAXERROR 20  
PARTCLSIZE 1e-017  
SR2PREC SINGLE  
**$ Distance units: m  
RESULTS XOFFSET 0.0000  
RESULTS YOFFSET 0.0000
```

RESULTS ROTATION 0.0000 **\$ (DEGREES)

RESULTS AXES-DIRECTIONS 1.0 -1.0 1.0

\$ ***

**\$ Definition of fundamental cartesian grid 定义直角坐标网格

GRID VARI 50 5 30

KDIR DOWN

DI IVAR

50*1

DJ JVAR

5*100

DK ALL

7500*1

DTOP

250*300

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VAMOD 2 0.5 1 0.5 0.5

NULL CON 1

PINCHOUTARRAY CON 1

VATYPE IVAR

49*1 2

POR CON 0.3

PERMI CON 1000

*****定义第一段离散井筒*****

**定义离散化井筒 油藏描述部分

WELLBORE 0.159

***WELLBORE rw 定义离散井筒内径，或者是循环井的油管内径 / 此关键字表示定义离散化井筒

***Indicates that a discretized well will be defined. Each discretized wellbore needs its own *WELLBORE keyword.

***Quantity "rw" is the inside well radius (m | ft | cm), or inside tubing radius when well is circulating.

***LAMINAR

***Forces the wellbore flow to be in laminar mode so that the flow correlations are not used. 模拟井筒流态为层流，不使用流动相关式

***Use this keyword for vertical or deviated wells, or runs where counter-current flow is present. 这个关键字用于直井或斜井，或者对向流的情况

```
CIRCWELL      0.18365      50      5      25      0
```

***CIRCWELL ra i j k nwbwt (*RELROUGH relrof) 循环井关键字格式，定义循环井信息

***ra=Annulus inside radius (m | ft | cm), which must be greater than the tubing radius rw. 环空内径，必须大于油管半径

*** i j k=I-J-K address of the grid block which defines the downhole end of the well (toe). 定义井筒末端网格（趾端）位置

*** This block must be at one end of the well structure defined by *RANGE.它必须在*RANGE 定义的井结构的一端

***nwbwt=Number of sections (blocks) in the circulating well that do not contain tubing. 定义循环井内不包含油管的网格数

WELLINFO

***Flags printing of detailed wellbore information. 在输出结果文件中打印详细的井筒信息标志

REGIME

***This keyword indicates that another method for friction pressure drop calculation will be used. 这个关键字表明计算采用相应的摩阻压

降计算公式

***It first evaluates the flow regime and then calculates friction pressure drop and liquid holdup accordingly. 首先评估流态，然后根据流态计算摩阻压降和持液率

** WELLWALL 0.059425 3.738e6 **Rt_o

*** WELLWALL rwo hcww

定义油管（壁）参数

** rwo=Tubing (wellbore) outside radius, which must not be less than tubing (wellbore) inner radius rw. 定义油管外径，其必须不小于有关内径 rw.

** hcww=Tubing (wellbore) wall heat conductivity (J/m-day-C | Btu/ft-day-F | J/cm-min-C). 定义油管热传导率

** ANNULUSWAL 0.186825 3.738e6 **Ran_o = Rcas_i 定义环空参数

** ANNULUSWAL rao (环空壁外径) hcaw (环空壁热传导率)

** CASING 0.19 3.738e6 5. **Rcas_o

** CASING rcas (套管外径) hccas (套管热传导率)

** nwbwca (Number of grid blocks in a discretized well without casing) 离散井中没有下套管的网格数

RANGE 50:50 1:5 25:25 ** 定义离散井的范围

**RANGE i1(:i2) j1(:j2) k1(:k2)

**Indicates the addresses of grid blocks through which the wellbore penetrates.

**All discretized wellbores require the first address line; a deviated well requires the second line as well. 所有的水平井都需要一行数据描述离散范围

**Each address line must indicate a range in exactly one direction.

每一行地址线只表明一个方向

**The total number of blocks penetrated must not exceed the dimension limit for well layers. 定义的离散范围总网格数不能超过井层的维数限制

**This keyword defines only the blocks which contain the discretized wellbore.

该关键字只定义含有离散井筒的网格

**For a horizontal wellbore the end that is connected to the surface will be determined 对于水平井，离散井部分与地面连接的一端是通过

井数据

**by the perforation keywords in the well data section. For a deviated wellbore the two ranges defined by the 中的射孔关键字定义；对于斜井，离散部分要由两行定义

**two *RANGE lines must have exactly one block in common, which also must be at one end of each range. 必须相连接

*****定义第二段离散井筒*****

```

WELLBORE 0.159                **Rt_in
  **LAMINAR
  CIRCWELL      0.18365        50      5      30      0      **Ran_in
  WELLINFO
  REGIME
** WELLWALL    0.059425    3.738e6    **Rt_o
** ANNULUSWAL 0.186825    3.738e6    **Ran_o = Rcas_i
** CASING     0.19      3.738e6 5.    **Rcas_o
      RANGE      50:50      1:5      30:30
PERMJ EQUALSI
  
```

PERMK EQUALSI

END-GRID

*****定义油藏岩石类型*****

ROCKTYPE 1

PRPOR 3100.

CPOR 1.8E-05

ROCKCP 1.5E+06

THCONR 1.5E+05

THCONW 5.E+04

THCONO 2.E+04

THCONG 140.

HLOSSPROP OVERBUR 1.E+06 8.E+04

UNDERBUR 0 0 **1.E+06 8.E+04

ROCKTYPE 2

PRPOR 3100.

CPOR 0

ROCKCP 0 **1.5

THCONR 0

THCONW 5.E+04

THCONO 2.E+04

THCONG 140.

HLOSSPROP OVERBUR 1.E+06 8.E+04

UNDERBUR 1.E+06 8.E+04

**THERMAL ROCK TYPE DESIGNATION 定义岩石物性类型，油藏为 1，注采离散井部分为 2

THTYPE CON 1. **RESERVOIR

THTYPE WELLBORE 50 1:5 25 CON 2. **INJECTOR

THTYPE WELLBORE 50 1:5 30 CON 2. **PRODUCER

*****定义流体模型*****

MODEL 2 2 2 1

CP **Liquid compressibility (1/kPa | 1/psi) at constant temperature
 4.463E-07 1.5E-6

CT1 **First coefficient of the thermal expansion correlation (1/C | 1/F). ct1 is the thermal expansion coefficient
 when ct2 = 0.
 1.563E-04 6.84E-4

CT2 **Second coefficient of the thermal expansion correlation (1/C**2 | 1/F**2).
 **The thermal expansion coefficient is $ct1 + T \cdot ct2$ where T is temperature expressed in absolute degrees (R or
 K).
 **See Second Temperature Coefficient below.

0.0E+0 0.0E+0

AVG **A B 气相粘度相关数据

0.0E+0 0.0E+0

BVG

0.0E+0 0.0E+0

** TEMP

VISCTABLE *****粘温曲线表

```
**$      temp
      1      0  20000000
     11      0   2000000
     20      0   450448
     40      0    22300
     60      0     3073
     80      0     680.6
    100      0    212.63
    120      0     85.54
    140      0     41.57
    160      0     23.32
    180      0     14.6
    200      0     9.96
    220      0     7.26
    240      0     5.59
    260      0     4.49
```

280	0	3.73
300	0	3.12883
320	0	2.696274
340	0	2.362967
360	0	2.100655
380	0	1.890752
400	0	1.720653
420	0	1.58157
440	0	1.467203
460	0	1.372926
480	0	1.295235
500	0	1.23141

*****定义相渗曲线*****

*ROCKFLUID

RPT 1 STONE2 WATWET

**

** Sw Krw Krow

** ---- -

SWT

**\$ Sw krw krow

0.130 0.000 0.948

0.178 0.033 0.786

0.227 0.070 0.637

0.275 0.110 0.502

0.323 0.151 0.381

0.372 0.193 0.275

0.420 0.236 0.184

0.468 0.280 0.109

0.517 0.324 0.052

0.565 0.369 0.014

第二十五期：离散井模型-数据文件

0.610	0.411	0.000
0.662	0.460	0.000
0.710	0.506	0.000
0.758	0.552	0.000
0.807	0.599	0.000
0.855	0.646	0.000
0.903	0.694	0.000
0.952	0.742	0.000
1.000	0.790	0.000

**

SLT

**\$	Sl	krq	krog
	0.245	0.250	0.000
	0.295	0.174	0.003
	0.346	0.117	0.014
	0.396	0.077	0.032

0.446	0.048	0.059
0.497	0.029	0.094
0.547	0.016	0.138
0.597	0.008	0.191
0.648	0.004	0.253
0.698	0.002	0.324
0.748	0.001	0.405
0.799	0.000	0.494
0.849	0.000	0.593
0.899	0.000	0.702
0.950	0.000	0.948

**WELL BORE RELATIVE PERMEABILITY TABLES

**=====

*RPT 2

*SWT **

```

** Sw      Krw      Krow
** ----      -
0.000000  0.000000  1.000000  0.000000
0.9999    1.000000  0.000000  0.000000
*SLT
** Sl      Krg      Krog
** ----      -
0.000000  1.000000  0.000000  0.000000
1.000000  0.000000  1.000000  0.000000

```

**WELL BORE RELATIVE PERMEABILITY TYPE

KRTYPE CON 1.

KRTYPE WELLBORE 50 1:5 25 CON 2.

KRTYPE WELLBORE 50 1:5 30 CON 2.

*****定义初始条件*****

*INITIAL

*VERTICAL *DEPTH_AVE

*INITREGION 1

REFPRES 3000

REFDEPTH 305

DWOC 330

DGOC 300

*****定义数值计算控制参数*****

*NUMERICAL

*PRECC 1E-5

*DTMAX 5.

*CONVERGE *TOTRES *NORMAL

*NORTH 50

*ITERMAX 50

NORM *PRESS 300

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NORM *TEMP 100

NORM *SATUR 0.3

NORM *Y 0.3

NORM *X 0.3

NORM *W 0.3

*****定义井及动态数据*****

RUN

DATE 1990 01 01.

DTWELL 0.001

*****SOURCE SINK WELL DEFINITIONS **定义源汇井

WELL 'Injector-U' FRAC 0.5

*****定义上部注入井 'Injector-U'*****

INJECTOR MOBWEIGHT 'Injector-U'

TINJW 266.9 **注入温度

```

QUAL 1          **注入干度
INCOMP WATER  1.0 0.0          **注入组成
OPERATE MAX BHP  5200. CONT REPEAT          **定注入压力 5.2MPa
** "Size" is 1x1x1 for noncirculating wellbore
**$           rad  geofac  wfrac  skin
GEOMETRY J  0.05  0.249  1.  0.
PERF  GEOA  'Injector-U'
**$ UBA           ff  Status  Connection
      50 1 25 / 1 1 1  1.  OPEN   FLOW-FROM  'SURFACE'

WELL  'Producer-U'  FRAC  0.5
*****定义上部生产井'Producer-U'*****
PRODUCER 'Producer-U'
OPERATE MIN BHP  4400.4 CONT REPEAT          **定压力生产 4.4MPa
OPERATE MAX STEAM 10. CONT REPEAT
**$           rad  geofac  wfrac  skin
  
```

```

GEOMETRY J 0.05 0.249 1. 0.
PERF GEOA 'Producer-U'
**$ UBA          ff Status Connection
    50 1 25 / 2 1 1  1.  OPEN    FLOW-TO 'SURFACE'

WELL 'Injector-L' FRAC 0.5
*****定义下部注入井'Injector-L' *****
INJECTOR MOBWEIGHT 'Injector-L'
TINJW 266.9
QUAL 1
INCOMP WATER 1.0 0.0
OPERATE MAX BHP 5200. CONT REPEAT
**$          rad geofac wfrac skin
GEOMETRY J 0.05 0.249 1. 0.
PERF GEOA 'Injector-L'
**$ UBA          ff Status Connection

```

50 1 30 / 1 1 1 1. OPEN FLOW-FROM 'SURFACE'

WELL 'Producer-L' FRAC 0.5

*****定义下部生产井'Producer-L'*****

PRODUCER 'Producer-L'

OPERATE MIN BHP 4400.4 CONT REPEAT

OPERATE MAX STEAM 10. CONT REPEAT

**\$ rad geofac wfrac skin

GEOMETRY J 0.05 0.249 1. 0.

PERF GEOA 'Producer-L'

**\$ UBA ff Status Connection

50 1 30 / 2 1 1 1. OPEN FLOW-TO 'SURFACE'

OPEN 'Injector-U'

OPEN 'Producer-U'

OPEN 'Injector-L'

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OPEN 'Producer-L'

DATE 1990 01 02.

DATE 2002 10 01.

STOP

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