Oil-Water Simulation using the IMPES Method

Objective

The objective of this exercise is to study effects of numerical dispersion, upstream selection of mobilities and capillary dispersion by variation of:

- grid block size
- time step size
- mobility selection
- capillary pressure

in simulation of displacement of oil by water.

Assignment

The oil-water IMPES model **ow.f** and input data files **SYST.DAT**, **PVT.DAT** and **SAT.DAT** may be copied from the home page of the course. Compile **ow.f**. The content of the input data files is self-explanatory. Output files are **SW.OUT**, **PO.OUT** and **WELLS.OUT**

a) Compile the program

Run the following cases:

b) No. of grid blocks: 5, 10, 50, 100. Time step size 1 sec. PCMLT=0 (no capillary pressure).
c) Time step sizes: 1, 5, 10 sec. No. of grid blocks 20. PCMLT=0 (no capillary pressure)
d) Upstream selection (USO and USW): 1.0, 0.5, 0.0. No. of grid blocks 20 Time step size 2.5 sec. PCMLT=0 (no capillary pressure).
e) Capillary pressure: PCMLT= 0., 1., 5 (multiplier for the input Pc-table in SAT.DAT). No. of grid blocks 20 Time step size 2.5 sec.

Plot Sw vs. x at t=300 sec. for all the cases under each task above (a-d) on the same figure. The saturation data may be found in the ouput file SW.OUT, and can be imported in Excel and plotted. **Please make comments for each case.**

Use the following data (identical to data in input files except for N and Δt):

$L = 100\ cm$	$A = 1000\ cm^3$	$k = 0.1\ Darcy$	$\phi = 0.25$
$c_r = 45 \cdot 10^{-6}\ atm^{-1}$	$Sw_i^{t=0} = 0.2$		
$Q_w = 25 cm^3/s$	$Po_i^{t=0} = 200\ atm$	$P_R = 200\ atm$	

Table 1

12 *NSAT*

Sw	***Kro***	***Krw***	***Pc (atm)***
0.2	0.95	0	1
0.3	0.86	0.01	0.52
0.35	0.8	0.021	0.41
0.4	0.71	0.039	0.34
0.45	0.59	0.058	0.28
0.5	0.46	0.09	0.23
0.55	0.36	0.245	0.18
0.6	0.21	0.42	0.14
0.65	0.12	0.545	0.1
0.7	0.06	0.8	0.06
0.75	0.02	0.91	0.03
0.8	0	0.96	0

Table 2

3 *NPVT*

P (atm)	***Bo***	***Bw***	***Muo (cp)***	***Muw (cp)***
100	1.522	1.0044	0.45	0.95
200	1.5	1.0	0.5	1.0
300	1.478	0.9956	0.55	1.05