Water Injection Wellbore Pressure Profile @model

Motivation

The stabilized water injection profile satisfies the assumptions of the Pressure Profile in Incompressible Stationary Quasi-Isothermal Isoviscous Pipe Flow @model.

For the stabilized flow the wellbore pressure profile is constant and wellbore temperature profile is changing very slowly.

This allows solving the pressure-temperature problem iteratively:

1. Iterations
   - Water Injection Wellbore Temperature Profile @model
   - Water Injection Wellbore Pressure Profile @model
2. Iteration
   - Water Injection Wellbore Temperature Profile @model
   - Water Injection Wellbore Pressure Profile @model
3. Iteration ...

Outputs

$p(l)$	Pressure distribution along the pipe
$q(l)$	Flowrate distribution along the pipe
$u(l)$	Flow velocity distribution along the pipe

Inputs

T_s	Intake temperature	$T(l)$	Along-pipe temperature profile
p_s	Intake pressure	$\rho(T, p)$	Fluid density
q_s	Intake flowrate	$\mu(T, p)$	Fluid viscosity
$z(l)$	Pipeline trajectory TVDss	d	Flow pipe diameter (tubing or casing depending on where flow occurs)
$\theta(l)$	Pipeline trajectory inclination, $\cos\theta(l) = \frac{dz}{dl}$	ϵ	Inner pipe wall roughness

Assumptions

Stationary flow	Homogenous flow	Isothermal or Quasi-isothermal conditions
Incompressible fluid $\rho(T,p) = \rho_s = \rm const$	Isoviscous flow $\mu(T,p) = \mu_s = \rm const$	Constant cross-section pipe area A along hole

Equations

Pressure profile	Pressure gradient profile	Fluid velocity	Fluid rate
(1) $p(l) = p_s + \rho_s \, g \, z(l) - \frac{\rho_s \, q_s^2}{2 A^2 d} f_s \, l$	(2) $\frac{dp}{dl} = \rho_s \, g \cos\theta(l) - \frac{\rho_s \, q_s^2}{2 A^2 d} f_s$	(3) $q(l) = q_s = \rm const$	(4) $u(l) = u_s = \frac{q_s}{A} = \rm const$

where

$f_s = f(\mathrm{Re}, \epsilon)$	Darcy friction factor (see Darcy friction factor in water producing/injecting wells @model) at intake point
$\mathrm{Re}_s = \frac{4 \rho_s q_s}{\pi d} \frac{1}{\mu_s}$	Reynolds number at intake point
$A = 0.25 \, \pi \, d^2$	flow pipe cross-section area (tubing or casing depending on where flow occurs)

See Also

Petroleum Industry / Upstream / Subsurface E&P Disciplines / Production Technology / Well Flow Performance / Lift Curves (LC) / Water Injection Wellbore Profile @model

[Pressure Profile in Incompressible Stationary Quasi-Isothermal Isoviscous Pipe Flow @model] [Darcy friction factor in water producing/injecting wells @model]

[Water Injection Wellbore Temperature Profile @model]