

Pseudo-Steady State Linear Pressure Diffusion @model

Motivation

In many practical cases the reservoir flow created by well or group of wells is getting aligned with a specific linear direction away from well.

This happens when well is placed in a [channel](#) or a narrow compartment. It also happens around fracture planes and conductive faults.

This type of flow is called [linear fluid flow](#) and corresponding [PTA type library models](#) provides a reference for [linear fluid flow](#) diagnostics.

Inputs & Outputs

Inputs		Outputs	
q_i	total sandface rate	$p(x)$	reservoir pressure
p_i	initial formation pressure		
d	reservoir channel width		
σ	transmissibility , $\sigma = \frac{k h}{\mu}$		
L	reservoir channel length towards the pressure support boundary		

k	absolute permeability
h	effective thickness
μ	dynamic fluid viscosity

Physical Model

Linear fluid flow	Homogenous reservoir	Finite reservoir flow boundary	Zero wellbore radius	Slightly compressible fluid flow	Constant rate production
$p(t, \mathbf{r}) \rightarrow p(x)$ $\mathbf{r} \in \mathbb{R}^2 = \{x, y\}$	$M(x, p) = M = \text{const}$ $\phi(x, p) = \phi = \text{const}$ $h(x) = h = \text{const}$	$0 \leq x \leq L_e$	$x_w = 0$	$c_t(p) = c_r + c = \text{const}$	$q_t = \text{const}$

Mathematical Model

(1) $\frac{\partial p}{\partial t} = 0 \Leftrightarrow \frac{d^2 p}{dx^2} = 0$	(2) $p(t, x \rightarrow L_e) = p_i$	(3) $\frac{\partial p(t, x)}{\partial x} \Big _{x \rightarrow 0} = \frac{q_t}{\sigma d}$
(4) $p(x) = p_i - \frac{q_t}{\sigma d}(x - L_e)$		

Applications

See also

[Physics](#) / [Fluid Dynamics](#) / [Linear fluid flow](#)

[[Radial Flow Pressure Diffusion @model](#)]