Schilthuis Aquifer expansion @model

Motivation

The most accurate way to simulate Aquifer Expansion (or shrinkage) is full-field 3D Dynamic Flow Model where Aquifer Expansion is treated as one of the fluid phases and accounts of geological heterogeneities, gas fluid properties, relperm properties and heat exchange with surrounding rocks.

Unfortunately, in many practical cases the detailed information on the aquifer is not available which does not allow a proper modelling of aquifer expansion using a geological framework.

Besides many practical applications require only knowledge of cumulative water influx from aquifer under pressure depletion.

This allows building an Aquifer Drive Models using analytical methods.

Inputs & Outputs

Inputs		Outputs	
$p(t)$	field-average formation pressure at time moment t	$Q^{\downarrow}_{AQ}(t)$	Cumulative subsurface water influx from aquifer
p_i	initial formation pressure	$q^{\downarrow}_{AQ}(t) = \frac{dQ^{\downarrow}_{AQ}}{dt}$	Subsurface water flowrate from aquifer
J_{AQ}	aquifer Productivity Index		

Physical Model

Radial Composite Reservoir	
Steady-state flow	
Aquifer pressure is constant	$p_{AQ}(t) = p_i = \mathrm{const}$
Aquifer Productivity Index is constant	$J_{AQ} = \mathrm{const}$

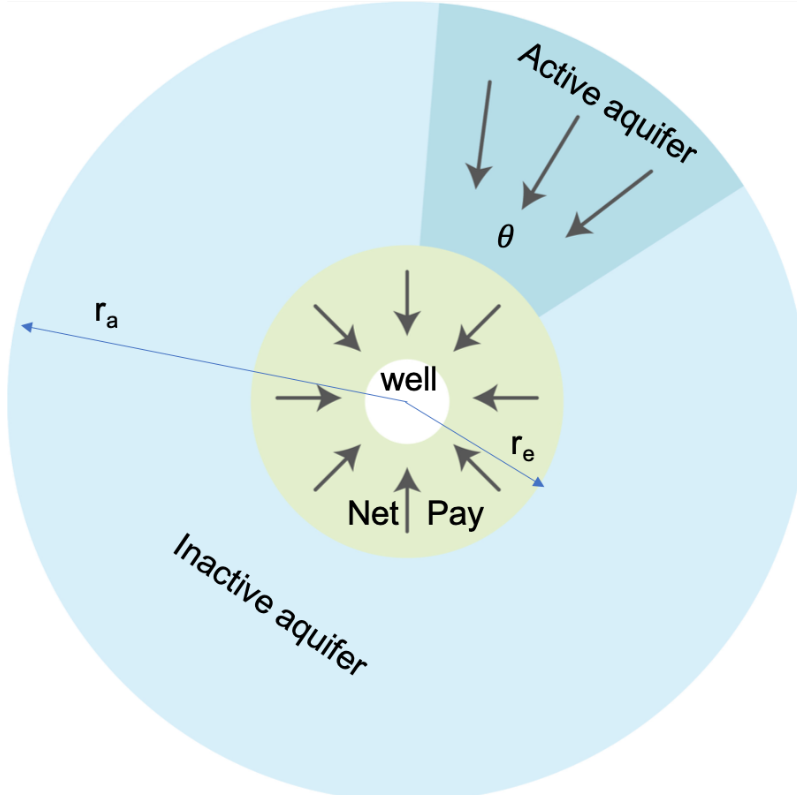

Fig. 1. Schilthuis aquifer drive schematic

Mathematical Model

(1) $Q^{\downarrow}_{AQ}(t) = J_{AQ} \cdot \left[p_i \cdot t - \int_0^t p(t) dt \right]$	(2) $q^{\downarrow}_{AQ}(t) = J_{AQ} \cdot (p_i - p(t))$

It maybe considered as partial case of Fetkovich Aquifer Drive @model with infinite Aquifer volume.

See Also

Petroleum Industry / Upstream / Subsurface E&P Disciplines / Field Study & Modelling / Aquifer Drive / Aquifer Drive Models

Reference

1. Schilthuis, R.J. 1936. Active Oil and Reservoir Energy. Trans., AIME 118: 33. https://doi.org/10.2118/936033-G