

Normalized Pseudo-Time

(1) $t^*(t) = \mu(p_{ref}) \cdot c_t(p_{ref}) \cdot \tau(t) = \mu(p_{ref}) \cdot c_t(p_{ref}) \cdot \int_0^t \frac{dt}{\mu(p) c_t(p)}$

where

p_{ref}	reference pressure
$\tau(t)$	pseudo-time at time moment t
$\mu(p)$	dynamic fluid viscosity
$c_t(p)$	total compressibility
$p(t)$	bottom-hole pressure or field average formation pressure as function of time (see below)

It is widely used in Pressure Diffusion @model and transient data analysis (PTA / RTA) of strongly compressible fluids.

The choice of reference pressure p_{ref} is made by engineer depending on common sense and objectives of the study.

The usual practise is to select $p_{ref} = p(t = 0)$ as the bottom-hole pressure at initial time moment.

Selection of $p(t)$ depends on objectives.

In Pressure Build Up (PBU) survey the $p(t)$ is calculated as sandface bottom-hole pressure: $p(t) = p_{wf}(t)$.

In Drawdown survey (DD) survey the $p(t)$ is calculated as field-average formation pressure: $p(t) = p_r(t)$.

In case the Normalized Pseudo-Time is used to linearize the Pressure Diffusion equation the choice of reference pressure is not going to affect the solution.

Normalized Pseudo-Time does represent a time in terms of physical property and has the same dimension unlike Pseudo-Time.

See also

Physics / Mechanics / Continuum mechanics / Fluid Mechanics / Fluid Dynamics / Pressure Diffusion / Pressure Diffusion @model

Petroleum Industry / Upstream / Subsurface E&P Disciplines / Well Testing / Pressure Testing

[Pseudo-Time]