Time-weighted Productivity Plot = t-weighted J-plot

One of the Productivity Diagnostics methods based on correlation between time-weighted average pressure drawdown $\overline{\delta p}$:

(1) $$\overline{\delta p}(t) = \frac{1}{t}\int_0^t \left(p_{wf}(\tau) - p_e(\tau)\right) d\tau$$

and time-weighted average total sandface flowrate $\bar{q}_t(t)$:

(2) $$\bar{q}_t(t) = \frac{1}{t}\int_0^t q_t(\tau) d\tau$$

where

τ	production/injection time
q_t	total sandface flowrate as function of time τ
p_e	drain-area formation pressure as function of time τ τ
p_{wf}	bottomhole pressure as function of time τ

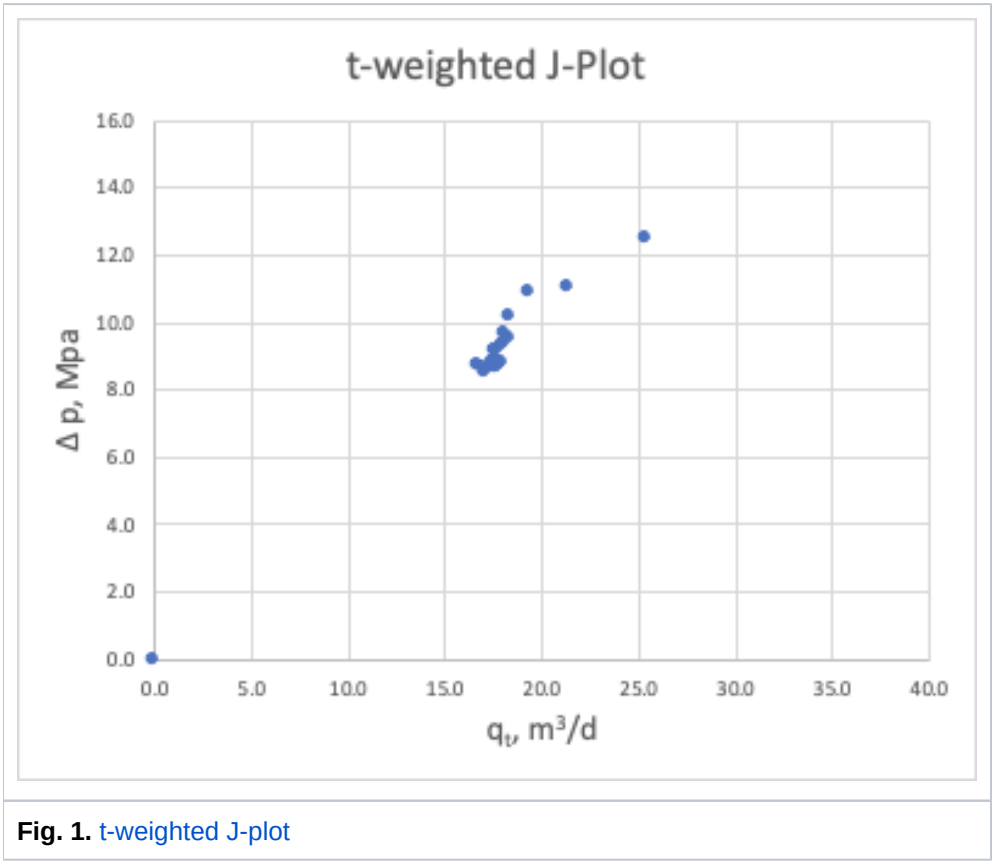

Fig. 1. t-weighted J-plot

It shows unit slope on log-log plot for stabilized reservoir flow:

(3) $$\overline{\delta p}(t) = J^{-1}\bar{q}_t(t)$$

where

J	constant productivity index

Due to integration procedure the t-weighted J-plot has a better tolerance to uncertainties in formation pressure and bottomhole pressure comparing to Unweighted J-plot and usually results in more accurate estimation of productivity index.

It is highly recommended to plot sandface flowrates rather than surface flowrates to achieve better linearity in correlation for stabilized reservoir flow.

Although it is equally applicable to producers and injectors, due to lack of BHP and formation pressure data availability for producers in most practical cases in the past the normalized Hall plot analysis was mostly applied for water injectors.

The average pressure drawdown $\overline{\delta p(t)}$ is usually calculated over interpolated values of formation pressure and bottomhole pressure :

$$\overline{\delta p}(t) = \frac{1}{t}\int_0^t \left(p_{wf}(\tau) - p_e(\tau)\right) d\tau = \frac{1}{t}\sum_k \left(p_{wf}(\tau_k) - p_e(\tau_k)\right) \delta\tau_k$$

The main difference Normalized Hall Plot and traditional Hall Plot is that Normalized Hall Plot is using conventional properties along the axis: average pressure drawdown $\overline{\delta p}$: and total sandface flowrate cumulatives $\bar{q}_t(t)$:.

See Also

Petroleum Industry / Upstream / Production / Subsurface Production / Field Study & Modelling / Production Analysis / Productivity Diagnostics